REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH

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TRAFFIC SAFETY STUDY OF THE REGIONAL ESCARPMENT ACCESS ROUTES UPON WHICH HEAVY TRAFFIC IS PERMITTED

BY:

THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH
ENGINEERING DEPARTMENT

AND

THE CITY OF HAMILTON TRAFFIC DEPARTMENT

J. R. G. LEACH, P. ENG.,
COMMISSIONER OF REGIONAL ENGINEERING

1983

REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH

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Mr. J.R.G. Leach, P. Eng.
Commissioner of Regional Engineering

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REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH

TRAFFIC SAFETY STUDY OF THE ESCARPMENT ACCESS ROUTES UPON WHICH HEAVY TRAFFIC IS PERMITTED

I INTRODUCTION

The Regional Engineering Services Committee, at its meeting of October 12, 1982, requested:-

> "That the Commissioner of Engineering review all suggestions pertaining to the improvement of vehicular safety on the Claremont Access and the other accesses within the Region in conjunction with the Ontario Trucking Association and the Ministry of Transportation and Communications and then report back to this Committee on these matters."-

In accordance with the direction of the Committee, this report has been prepared to review and assess concerns with respect to vehicular safety on the Mountain Access Routes within the Region, upon which heavy traffic is permitted.(1) In undertaking this study, information was reviewed and assessed concerning the existing operation of the Access routes, and contact was made with representatives of 59 Government and private agencies concerning issues related to heavy vehicle operation and safety, including:

a) 32 Municipalities. (19 responses)
b) 9 Provincial Governments. (7 responses)
c) 7 heavy truck or engine manufacturers. (5 responses)
d) 2 braking system manufacturers or representatives. (2 responses)
e) 6 transportation research agencies. (5 responses)
f) The Canadian Automobile Association.
g) Transport Canada.
h) The Ontario Trucking Association.

Each of the Mountain Access Routes under the jurisdiction of the Region, on which heavy traffic is permitted, was reviewed in terms of its physical and operational characteristics including vehicle classifications, speeds and collision history with special analysis of collisions in which brake defects were reported.

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(1) In accordance with Regional By-law R76-144, "heavy traffic" is any vehicle with a registered gross weight in excess of 8,000 lbs.

Twenty-one countermeasures were reviewed and considered for application on the Mountain Access Routes. Assessments were made concerning the cost, effectiveness and potential application of each countermeasure.

Recommendations for implementation were subsequently formulated from an assessment of:

a) the physical and traffic characteristics of the Mountain Access Routes;

b) the history of collisions occurring on the Mountain Access Routes;

c) the history of collisions involving brake-related defects on the Mountain Access Routes;

d) the history of collisions involving heavy vehicles;

e) existing legislation and suggested practices with respect to vehicle equipment, operation and inspection;

f) existing heavy vehicle driver training information and procedures;

g) various countermeasure alternatives;

h) the previous experience of other Municipalities, Provinces and States;

i) alternative routes for heavy vehicles.

The allocation of Regional financial resources to the Mountain Access Routes should be placed in perspective with respect to the availability of funds and the cost-effective allocation of these funds in terms of improving the safety or operation of the roadway network.

The recommendations are based on the effective allocation of funds for the countermeasures studied. The implementation of these improvements involving the Region should be placed in an appropriate order of priority with all other contemplated roadway improvements.

II SUMMARY OF FINDINGS

NOTE: Any reference to "Access Routes" refers to the Mountain Access Routes under Regional jurisdiction upon which heavy traffic is permitted. The Highway 20/Centennial Parkway Access is also included, as the bottom of the Access is under Regional jurisdiction.

1) Heavy vehicles account for between 3 and 6 percent of the total traffic on any particular Access Route upon which heavy traffic is permitted, with the exception of New Mountain Road and Fifty Road, which have 2 percent or less heavy vehicle traffic, and Centennial Parkway, which has over 9 percent heavy traffic.

2) The 85th percentile measured speeds for automobiles (including equivalent light trucks and buses) differed from the posted speed limits in the downbound direction on the Access Routes by between -5.5 and +24.5 km/h.

3) The 85th percentile measured speeds for heavy vehicles differed from the posted speed limits in the downbound direction on the Access Routes by between -25.0 and +24.5 km/h.

4) Higher collision rates than those experienced on typical Hamilton Arterial roads are incurred on the Kenilworth Access, New Mountain Road, the Jolley Cut and Fifty Road.

5) In the five-year period (1977 - 1981), eighteen (18) brake defect related collisions have been reported on the eight Access Routes (includes Regional portions of Hwy 20 only). In terms of brake-defect collision rates, those collisions represent one brake-related incident per 10 million downbound vehicles on the Access Routes.

6) The present mechanical fitness requirements for dump vehicles are more stringent than for all other vehicles in lighter and heavier weight categories.

7) The present mechanical fitness requirements for trailer units are less than the requirements for all other vehicles (including automobiles).

8) Emergency braking systems (spring brakes) are mandatory on tractor and trailer units for all units manufactured since 1975. Prior to 1975, a different emergency braking system was commonly installed.

9) Heavy vehicles, in most cases, are not being operated properly in the downbound direction of the Access Routes. Loaded tractor trailer units should be operated in an appropriate gear which would normally result in vehicle speeds between 15 and 30 km/h.

10) Exemptions in the Ontario Highway Traffic Act permit the operation of heavy vehicles by Class G (passenger car) licence holders under certain conditions.

11) Based on roadside inspections of heavy vehicles, 30 percent of the heavy vehicles inspected were detained due to mechanical and/or licensing problems.

12) Of the twenty-one (21) countermeasures to accidents on the Accesses studied, the following seven are not recommended, as they are considered to be either ineffective or not viable:

Countermeasure No.	Description
2	Lower Speed Limits for All Vehicles
3	Differential Speed Limits
5	Low Gear Legislation
7	Upper Weight Limit or Vehicle Class Restrictions
11	Traffic Signal Pre-Emption Devices
12	Bridge Over Main and King Streets
13	Tunnel Under Main and King Streets

13) Of the countermeasures studied, the following six have a low implementation priority and are of questionable value in terms of cost-effectiveness:

Countermeasure No.	Description
1	Designated Truck Lanes
6 i)	Heavy Vehicle Prohibition: Total Prohibition
ii)	Heavy Vehicle Prohibition, Permit System
8	Additional Advisory Signs and Devices
9	Escape Ramps
20	Vehicle Speed Retarding Devices
21	Emergency Braking Systems

14) Of the countermeasures studied, the following two may represent some reduction in heavy vehicle traffic on the Access Routes. However, their implementation should be considered as part of overall improvements to the transportation system.

Countermeasure No.	Description
14	Perimeter Industrial Road (from Nanticoke)
15	Highway 6 Corridor Improvements

15) Of the countermeasures studied, the following countermeasure would represent a reduction in heavy vehicle traffic on the Access Routes as it provides direct connections to the Provincial Highway System.

Countermeasure No.	Description
16	East-West/North-South Transportation Facility

16) Of the countermeasures studied, the following five are recommended for implementation:

Countermeasure No.	Description
4	Vehicle/Trailer Inspections
10	Redirectional Barriers (where detailed studies indicate effectiveness)
17	Inspection Stations
18	Automatic Monitoring/Enforcement Devices
19	Driver Training and Information-

III RECOMMENDATIONS - GENERAL

1) That the Ministry of Transportation and Communications give consideration to enacting legislation that will subject heavy vehicles (including trailer units) to an inspection program based on mileage, time period, or a combination thereof sufficient and reasonable to ensure the mechanical fitness of heavy vehicles (including trailer units).

2) That the Ministry of Transportation and Communications give consideration to promoting and participating in the Canadian Vehicle Safety Alliance (C.V.S.A.), which is the body for setting safety regulations for inter-Provincial commercial vehicles.

3) That the Ministry of Transportation and Communications give consideration to undertaking a study of heavy vehicle licenced drivers to determine their knowledge and compliance with the procedures as detailed in the Ontario Truck and Bus Drivers Manual, particularly with respect to vehicle operating procedures on downgrades, and that the MTC take actions as deemed necessary and appropriate.

4) That the Ministry of Transportation and Communications give consideration to undertaking a study to designate a Highway 6 improvement corridor (from Nanticoke).

5) That the Ministry of Transportation and Communications give consideration to establishing either permanent truck inspection stations on Highway 20 and Highway 6 south of the City limits, or a review of their program of random heavy vehicle inspections.

6) That the Ministry of Transportation and Communications give consideration to providing funds for a joint pilot project involving the installation of an automatic device which would be used to identify speeding and red-light infractions, such that this information could be forwarded to the trucking companies.

7) That the Ministry of Transportation and Communications give consideration to implementing an air-brake endorsement to the driver licencing classification system.

8) That the Ministry of Transportation and Communications give consideration to implementing an engine-retarding device endorsement to the driver licencing classification system.

9) That the Ministry of Transportation and Communications give consideration to rescinding the exemption of the Class D licence requirement for heavy vehicle operation, particularly if the vehicle is air-brake equipped, or if the vehicle is operated by a person other than the vehicle owner.

10) That the Region contact the Ontario Trucking Association and the Hamilton Trucking Council expressing concern with respect to the operation and maintenance of heavy vehicles within the Region, and further, that these organizations be requested to bring to the attention of their members the importance of the following:

- a) proper gear selection and speeds for vehicles proceeding on downgrades.
- b) proper airbrake operation.
- c) proper engine retarder operation (for vehicles so equipped).
- d) proper vehicle and trailer inspection.
- e) proper vehicle and trailer preventive maintenance programs.
- f) any other matters the Associations deem as important and relevant with respect to the safe operation of heavy vehicles.

11) That the Region continue to place high importance on the implementation of both the East-West/North-South corridor improvements and the Perimeter Industrial Road.

12) That the Region erect signs for both directions on the Access Routes on which heavy vehicles are permitted to the effect that slow-moving vehicles engage their 4-way flashers while proceeding on the grade.

RECOMMENDATIONS SITE-SPECIFIC

Claremont Access

No site-specific measures apply.

Kenilworth Access

1) Redirectional barriers, where appropriate, at high accident locations.
2) Enforcement of speeding violations.
3) Roadway delineation and signing improvements in the vicinity of the traffic circle.

Jolley Cut

1) Redirectional barriers, where appropriate, at high accident locations.
2) Enforcement of speeding violations.

New Mountain Road

1) Due to roadway characteristics, heavy traffic should be prohibited.
2) Increased enforcement of speeding violations.
3) Roadway delineation and signing improvements.
4) Review of pavement surface skid resistance characteristics.

Sydenham Road

1) Increased enforcement of speeding violations.

Wilson Street

1) Increased enforcement of speeding violations.

Fifty Road

1) Due to roadway characteristics, heavy traffic should be prohibited.
2) Reduce speed limit to 50 km/h.
3) Roadway delineation and signing improvements, particularly on curves.

IV BACKGROUND INFORMATION

A. EXISTING CONDITIONS - SUMMARY

1. Physical

Physical	Length	Number of Lanes	Average % Grade	Max. % Grade
Claremont Access	2.00 km	5-7	5.1 ✓	6.0
Kenilworth Access	2.12 km	4	3.8	5.1
Jolley Cut	1.37 km	4	5.1	6.4
New Mountain Road	0.80 km	2	11.2	12.3
Fifty Road	1.16 km	2	8.6	12.0
Sydenham Road	1.07 km	1-2	6.5	9.4
Wilson Street	3.07 km	2-3	3.3	5.7
Centennial Parkway (Hwy 20)	1.20 km	4	5.7 ✓	5.7

2. Vehicle Classification: (weekday downbound traffic only, 7 a.m. to 10 a.m. and 2 p.m. to 6 p.m.)

Access Name	Total Vehicles (AWDT)	% Heavy Vehicles
Claremont Access	26,370	2.9
Kenilworth Access	20,850	3.8(1)
Jolley Cut	24,220	6.2
New Mountain Road	3,530	1.6
Fifty Road	800 (Est)	2.0
Sydenham Road	3,200 (Est)	5.1
Wilson Street	9,250 (Est)	3.4
Centennial Parkway (Hwy 20)	19,500	9.6

Heavy vehicles account for between 3 and 6 percent of the total traffic on any particular Access Route upon which heavy traffic is permitted, with the exception of New Mountain Road and Fifty Road, which have 2 percent or less heavy vehicle traffic, and Centennial Parkway, which has over 9 percent heavy vehicle traffic.

Of the heavy vehicles observed on the seven accesses during the observation periods, 80 percent were heavy single-unit trucks, 15 percent were dump trucks, and 5 percent were heavy multiple-unit trucks.

Out of the 43 heavy multiple-unit trucks observed on the seven accesses during the observation periods, thirty-five (81%) were on the Claremont Access.

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(1) On the top half, between Mountain Brow Boulevard and the Sherman Access.

3. Vehicle Speeds

	A	B	C	D
		85th Percentile (1)		
Access Name	Posted Speed	Autos & Buses	Heavy Vehicles (2)	Speed Difference C - A
Claremont Access	70	72.5	68.0	- 2.0
Kenilworth Access	60	80.5	66.5	+ 6.5
Jolley Cut	50	74.5	58.0	+ 8.0
New Mountain Road	50	62.5	48.5	- 1.5
Fifty Road	60	44.5	35.0	-25.0
Sydenham Road	60	70.5	64.5	+ 4.5
Wilson Street	70	76.5	72.5	+ 2.5
Centennial Parkway (Hwy 20)	70 cars/ 50 trucks	91.5	74.5	+24.5

In every case, except Fifty Road, the 85th percentile speed of automobiles and buses was greater than the posted speed by as much as 21.5 km/h. The 85th percentile speed for heavy vehicles was less than the posted speed for only the Claremont Access, the New Mountain Road Access and the Fifty Road Access.

Highway 20, which has a lower posted speed limit for trucks, exhibits higher speeds than the other accesses, and trucks are exceeding the posted lower limit by 24.5 km/h (based on 85th percentile speeds).

4. Collision History (all motor vehicles)

Access Name	5 Year Collisions/MVKM	5 Year Brake Defect-Related Collisions/MVKM
Claremont Access	1.61	0.01
Kenilworth Access	2.78	0.07
Jolley Cut	2.40	0.08
New Mountain Road	17.50	0.45
Fifty Road	10.11	0.59
Sydenham Road	0.70	0.00
Wilson Street	1.90	0.00
Centennial Parkway (Hwy 20)	see note (3)	see note (3)

NOTE: The average collision rate for Hamilton arterials (excluding intersections) was 1.94 collisions/MVKM (1981).

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(1) For downbound vehicles, based on seven-hour weekday counts, 7 a.m. - 10 a.m., and 2 p.m. - 6 p.m.

(2) This speed represents the 85th percentile speed for all dump trucks, single unit heavy, multiple unit heavy vehicles surveyed.

(3) Not available. This roadway is under the jurisdiction of the MTC with the exception of the portions of the roadway within 60 m of King Street. See Section IV B (8) for collision history at intersection with King Street.

Most of the collisions on the Kenilworth Access(1) occurred at the junction with the ramps from the Sherman Access East or the Kenilworth Traffic Circle at Kimberly Drive.

Most of the collisions on the Jolley Cut(1) were associated with loss of control of the vehicle on the upper curved sections of the Jolley Cut resulting in "head-on" or "off the road" collisions.

The majority of collisions on New Mountain Road(1) were associated with loss of control of the vehicle by the vehicle operator under wet road conditions, particularly on the curved roadway approach to the railway overpass.

The majority of collisions on Fifty Road(1) occurred on or in close proximity to the roadway curves, particularly on the curve south of Reservoir Park Road.

5. Vehicle Lane Classification (Heavy Vehicles Only)

- for multi lane Access Routes in the downbound direction.
- conducted between 7 a.m. - 10 a.m. and 2 p.m. - 6 p.m.

	"Passing" Lane		Curb Lane(2)		Total	
Access Name	No.	%	No.	%	No.	%
Claremont Access	2	1.0%	189	99.0%	191	100%
Kenilworth Access	5	3.2%	149	96.8%	154	100%
Jolley Cut	57	14.6%	331	85.4%	388	100%

Only between 1 and 15 percent of heavy vehicles using the multi-lane Access Routes in the downbound direction utilize the "passing" lane.

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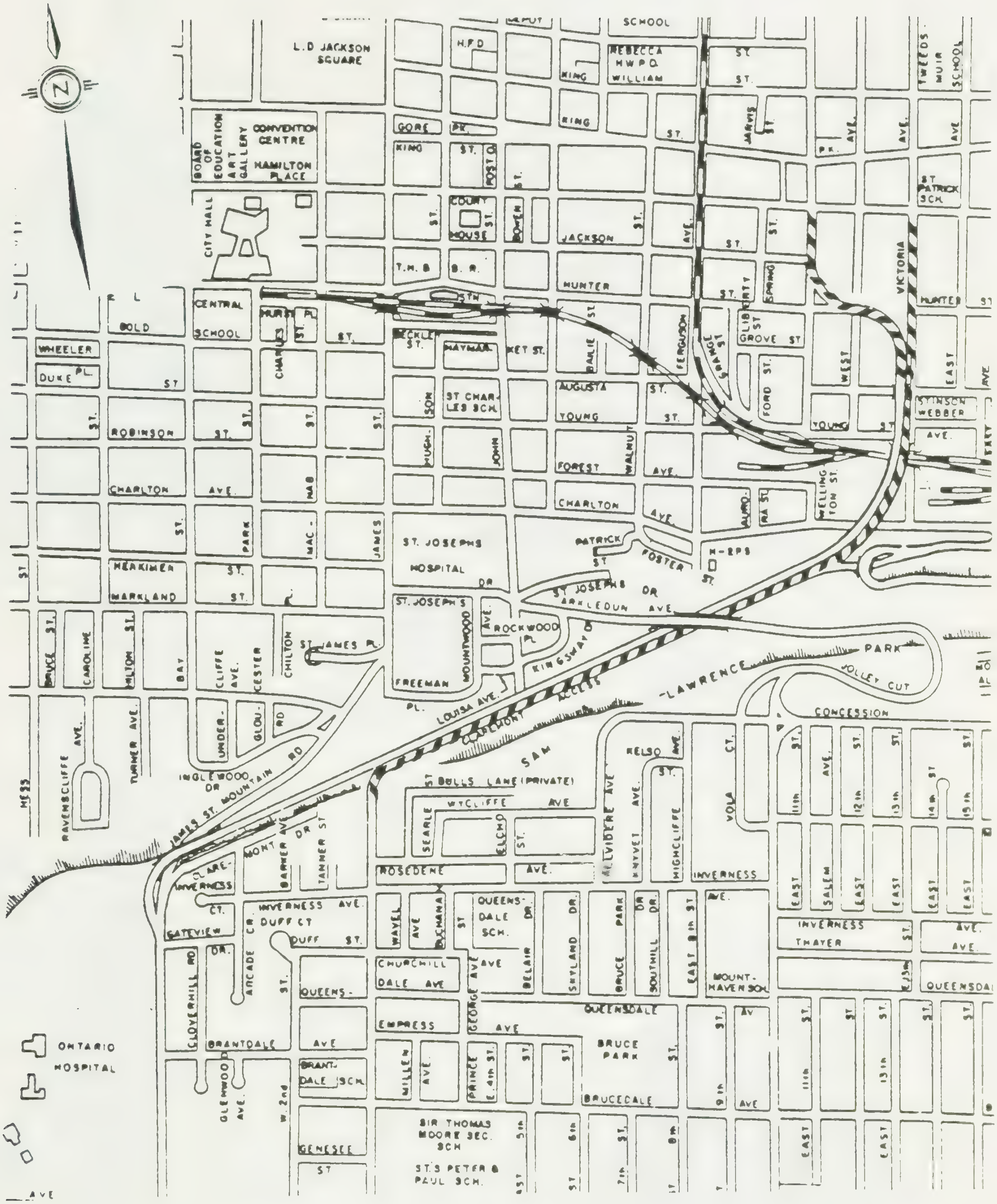
(1) Based on a review of collision diagrams prepared for the four-year period 1979 - 1982 inclusive.

(2) In the case of the Claremont Access, the figure for "Curb Lane" includes the Centre Lane and the Curb on the 3 lane section.

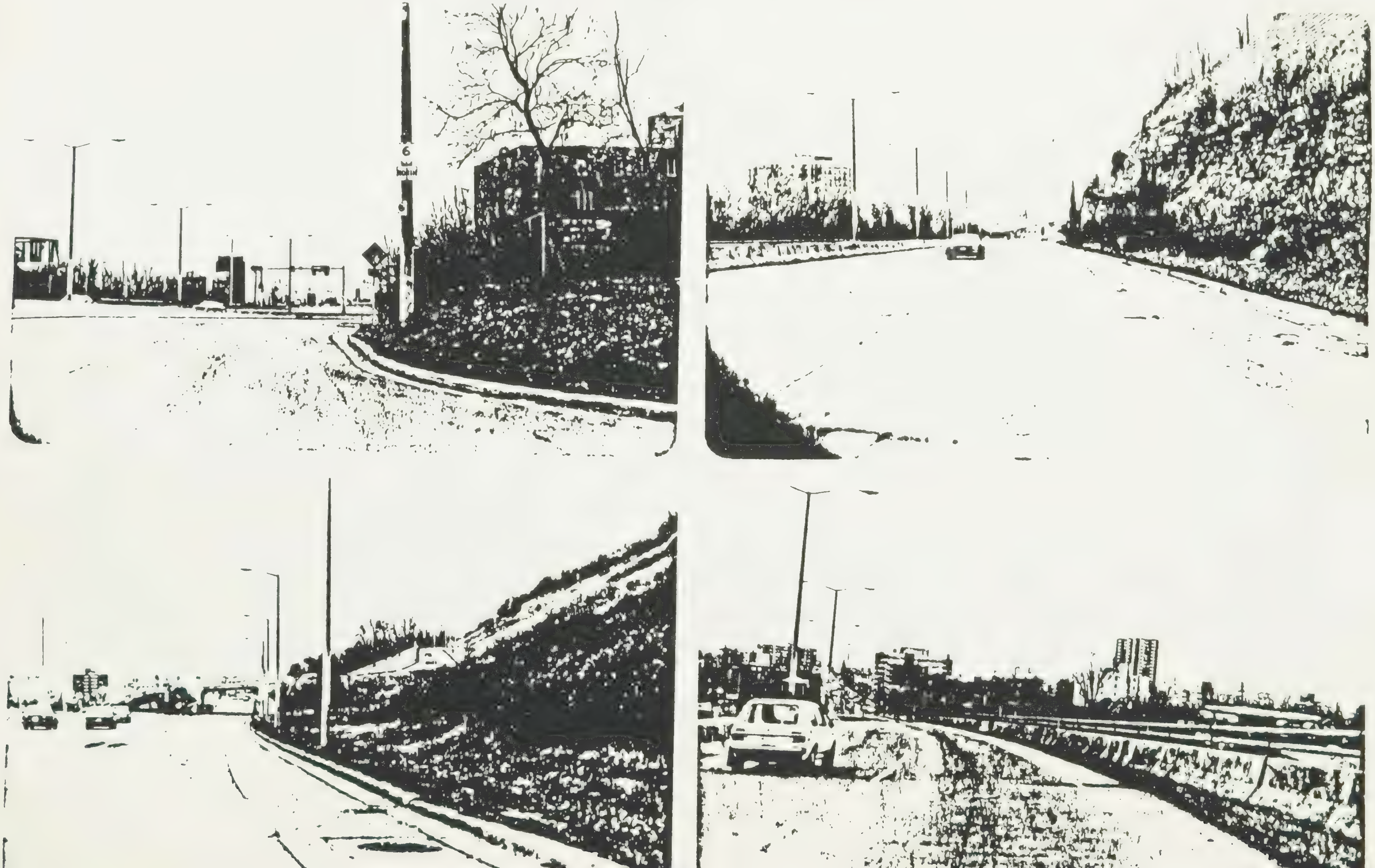
The majority (85.4% - 99%) of heavy vehicles are utilizing the curb lane(s).

CLAREMONT ACCESS



SCALE 1" = 1000'

CLAREMONT ACCESS



B. EXISTING CONDITIONS-DETAIL

1. CLAREMONT ACCESS

a. Description

Length - 2.0 km
Number of Lanes - 5-6
1981 AWDT - 26,370
Grade - 5.1% Average, 6.0% Maximum
Posted Speed Limit - 70 km/h
Urban or Rural Area - urban

b. Traffic Characteristics - (% in parenthesis)

(7 - 10 a.m. plus 2 - 6 p.m. Thursday, October 21, 1982)
(Downbound Direction Only)

Vehicle Classification		Vehicle Speeds (85th percentiles)	
Total Vehicles	- 6,580		
Automobiles & Buses	- 6,390 (97.1)	Automobiles & Buses	- 72.5 km/h
Dump Trucks	- 39 (0.6)	Dump Trucks	- 68.0 km/h
Single Unit Heavy	- 117 (1.8)	Single Unit Heavy	- 68.5 km/h
Multiple Unit Heavy	- 35 (0.5)	Multiple Unit Heavy	- 62.0 km/h

(Claremont Access, excluding Main/Victoria Intersection)

Collision History		Collisions with Brake Defects	
5 Year Collisions /MVKM(1)	- 1.61	Brake Defects Reported in Collisions	
5 Year Collisions	- 149	5 Year Total	- 1
Rear End	- 28 (18.8)	Automobiles & Buses	- 1
Sideswipe	- 22 (14.8)	Dump Trucks	- 0
Angle	- 29 (19.5)	Single Unit Heavy	- 0
Turning Movement	- 3 (2.0)	Multiple Unit Heavy	- 0
Approaching	- 11 (7.4)	Brake Defects/MVKM	- 0.01
Single Motor Veh.	- 42 (28.2)		
Other	- 14 (9.4)		

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(1) All 5 year summaries are for the period 1977 to 1981 inclusive.

MVKM - Million Vehicle Kilometres

Collision History

Collisions with Brake Defects

(Main/Victoria Intersection)

5 Year Collisions /MV Entering	1.67	
5 Year Collisions	152	
Rear End	16	(10.5)
Swideswipe	13	(8.6)
Angle	73	(48.0)
Turning Movement	31	(20.4)
Approaching	6	(3.9)
Single Motor Veh.	3	(2.0)
Other	10	(6.6)

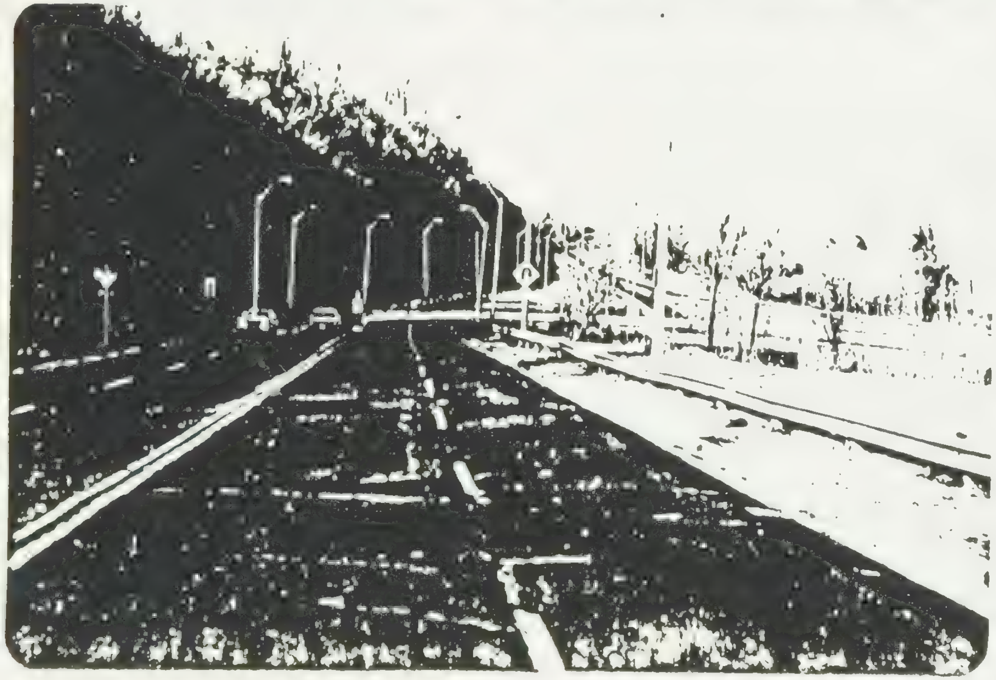
Brake Defects Reported in Collisions	
5 Year Total	1
Automobiles & Buses	0
Dump Trucks	0
Single Unit Heavy	1
Multiple Unit Heavy	0
Brake Defects /MV Entering	0.01

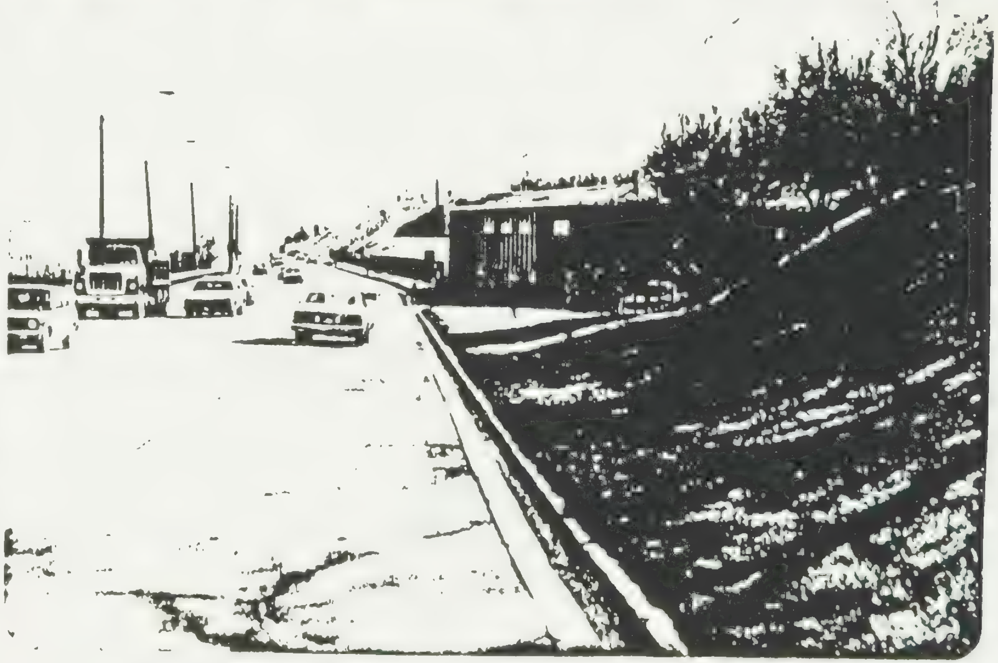
MV - Million Vehicles

KENILWORTH ACCESS

SCALE 1" = 1000'

KENILWORTH ACCESS





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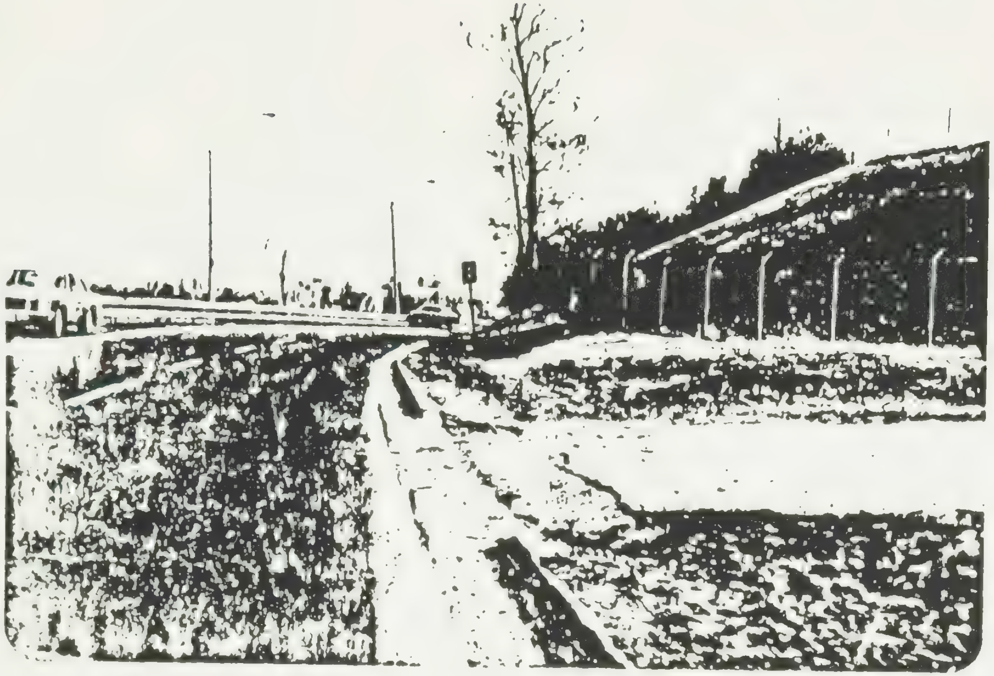

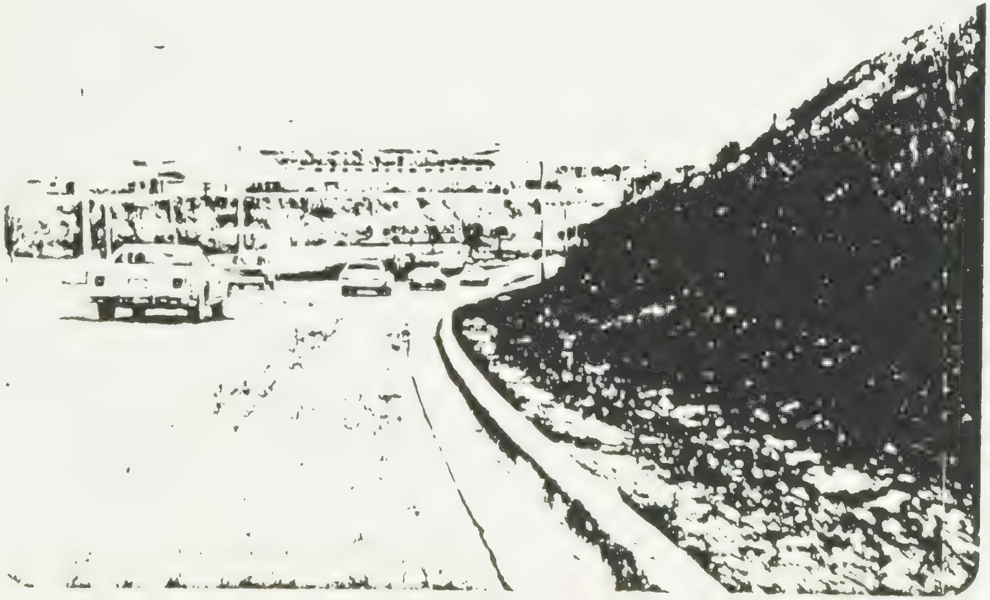

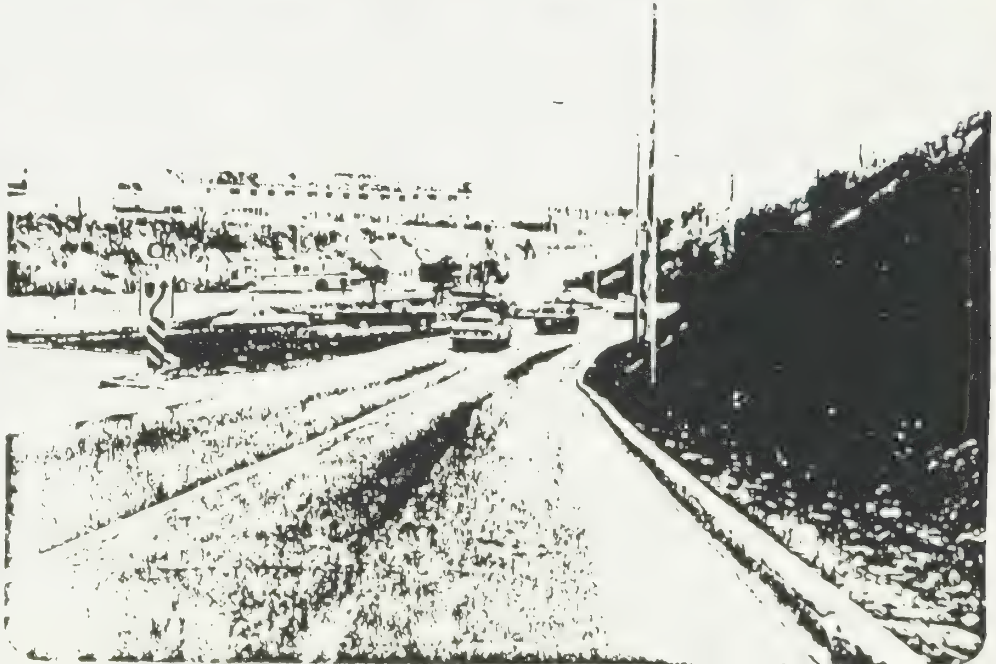

2. KENILWORTH ACCESS

a. Description

Length - 2.12 km (Mountain Brow to sharp turn)

Number of Lanes - 4

1981 AWDT - 20,850

Grade - 3.8% Average, 5.1% Maximum

Posted Speed Limit - 60 km/h

Urban or Rural Area - urban

b. Traffic Characteristics - (% in parenthesis)

(7 - 10 a.m. plus 2 - 6 p.m. Monday, October 25, 1982)
(Downbound Direction Only)

Vehicle Classification		Vehicle Speeds (85th percentiles)	
Total Vehicles	- 4,100		
Automobiles & Buses	- 3,946 (96.2)	Automobiles & Buses	- 80.5 km/h
Dump Trucks	- 27 (0.7)	Dump Trucks	- 66.0 km/h
Single Unit Heavy	- 123 (3.0)	Single Unit Heavy	- 66.0 km/h
Multiple Unit Heavy	- 4 (0.1)	Multiple Unit Heavy	- 57.0 km/h(1)

Collision History		Collisions with Brake Defects	
5 Year Collisions /MVKM	- 2.78	Brake Defects Reported in Collisions	
5 Year Collisions	- 236	5 Year Total	- 3
Rear End	- 68 (28.8)	Automobiles & Buses	- 2
Sideswipe	- 43 (18.2)	Dump Trucks	- 1
Angle	- 33 (14.0)	Single Unit Heavy	- 0
Turning Movement	- 11 (4.7)	Multiple Unit Heavy	- 0
Approaching	- 29 (12.3)	Brake Defects/MVKM	- 0.07
Single Motor Veh.	- 37 (15.7)		
Other	- 15 (6.4)		

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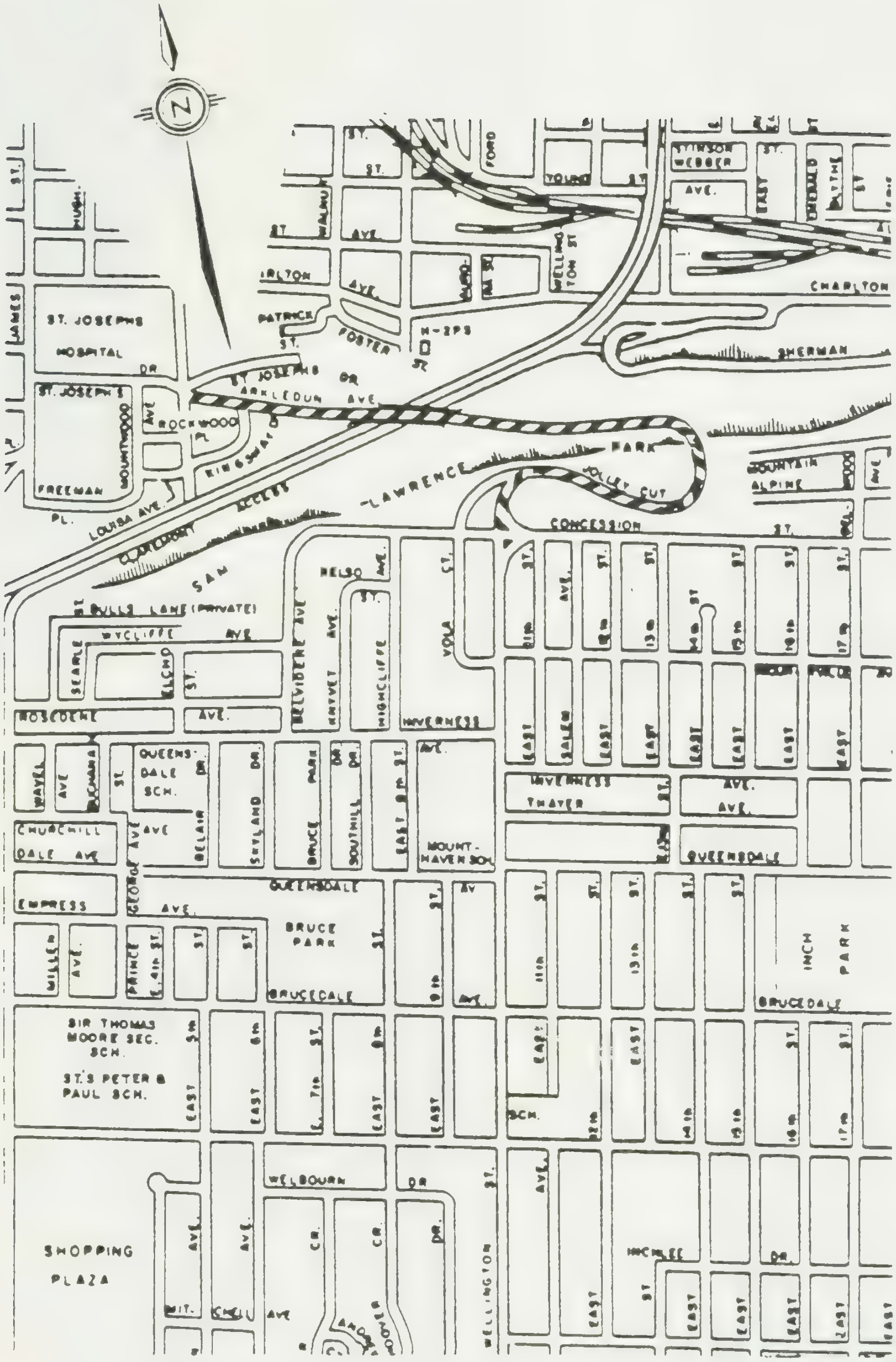
(1) Small sample size

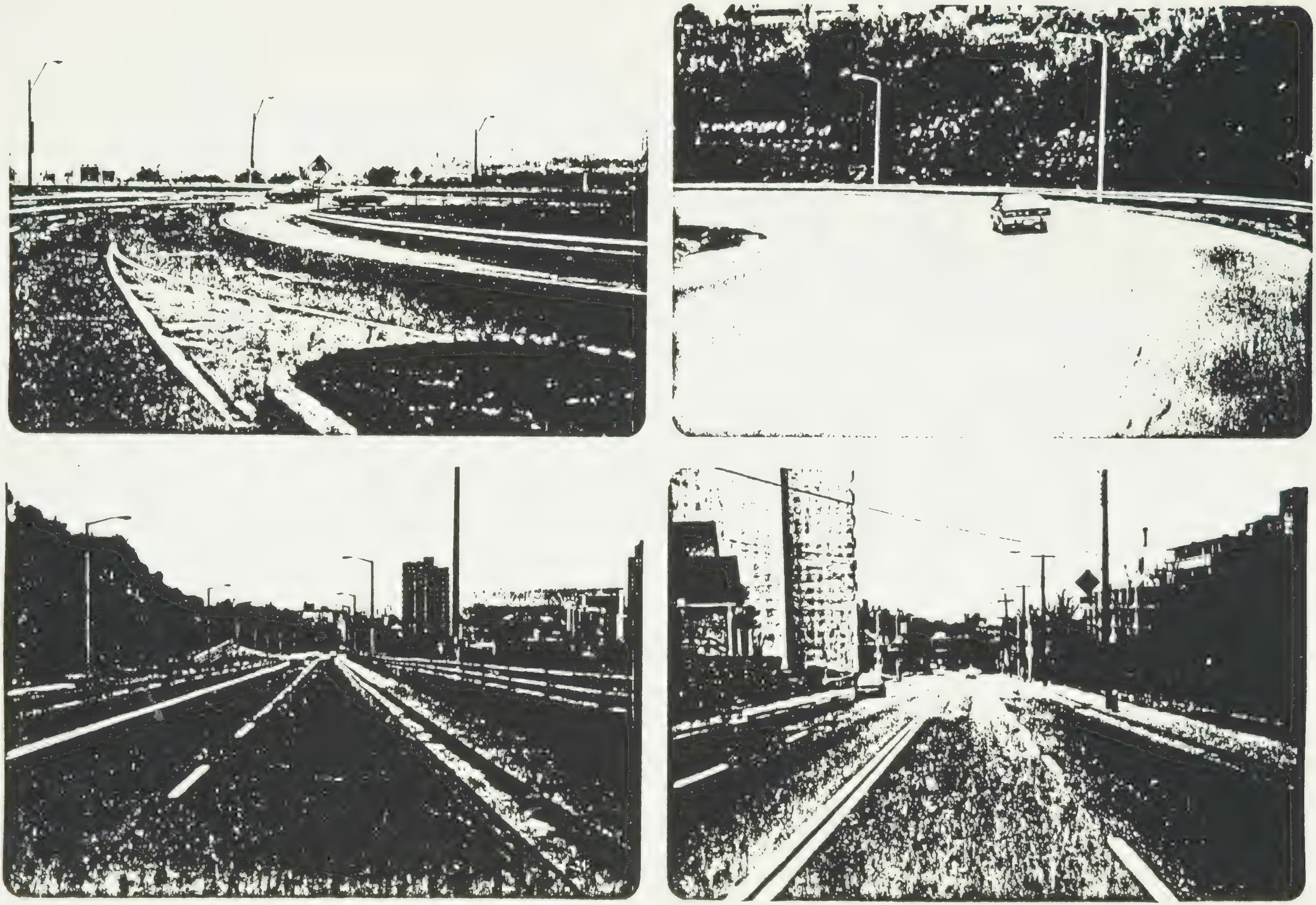
MVKM - Million Vehicle Kilometres

JOLLEY CUT



SCALE 1" = 1000'

JOLLEY CUT



3. JOLLEY CUT

a. Description

Length - 1.37 km
Number of Lanes - 4
1981 AWDT - 24,220
Grade - 5.0% Average, 6.4% Maximum
Posted Speed Limit - 50 km/h
Urban or Rural Area - urban

b. Traffic Characteristics - (% in parenthesis)

(7 - 10 a.m. plus 2 - 6 p.m. Tuesday, October 26, 1982)
(Downbound Direction Only)

Vehicle Classification		Vehicle Speeds (85th percentiles)	
Total Vehicles	- 6,287		
Automobiles & Buses	- 5,899 (93.8)	Automobiles & Buses	- 74.5 km/h
Dump Trucks	- 41 (0.7)	Dump Trucks	- 60.0 km/h
Single Unit Heavy	- 345 (5.5)	Single Unit Heavy	- 56.0 km/h
Multiple Unit Heavy	- 2 (-)	Multiple Unit Heavy	- 51.0 km/h(1)

(Jolley Cut, excluding St. Joseph's/John Intersection)

Collision History		Collisions with Brake Defects	
5 Year Collisions /MVKM	- 2.4	Brake Defects Reported in Collisions	
5 Year Collisions	- 137	5 Year Total	- 5
Rear End	- 38 (27.7)	Automobiles & Buses	- 4
Sideswipe	- 30 (21.9)	Dump Trucks	- 0
Angle	- 19 (13.9)	Single Unit Heavy	- 0
Turning Movement	- 5 (3.6)	Multiple Unit Heavy	- 1
Approaching	- 11 (8.0)	Brake Defects/MVKM	- 0.08
Single Motor Veh.	- 14 (10.2)		
Other	- 20 (14.6)		

---

(1) Small sample size

MVKM - Million Vehicle Kilometres

Collision History

Collisions with Brake Defects

(St. Joseph's/John Intersection)

5 Year Collisions /MV Entering	- 0.68	
5 Year Collisions	- 33	
Rear End	- 12	(36.4)
Sideswipe	- 6	(18.2)
Angle	- 7	(21.2)
Turning Movement	- 3	(9.1)
Approaching	- 3	(9.1)
Single Motor Veh.	- 1	(3.0)
Other	- 1	(3.0)

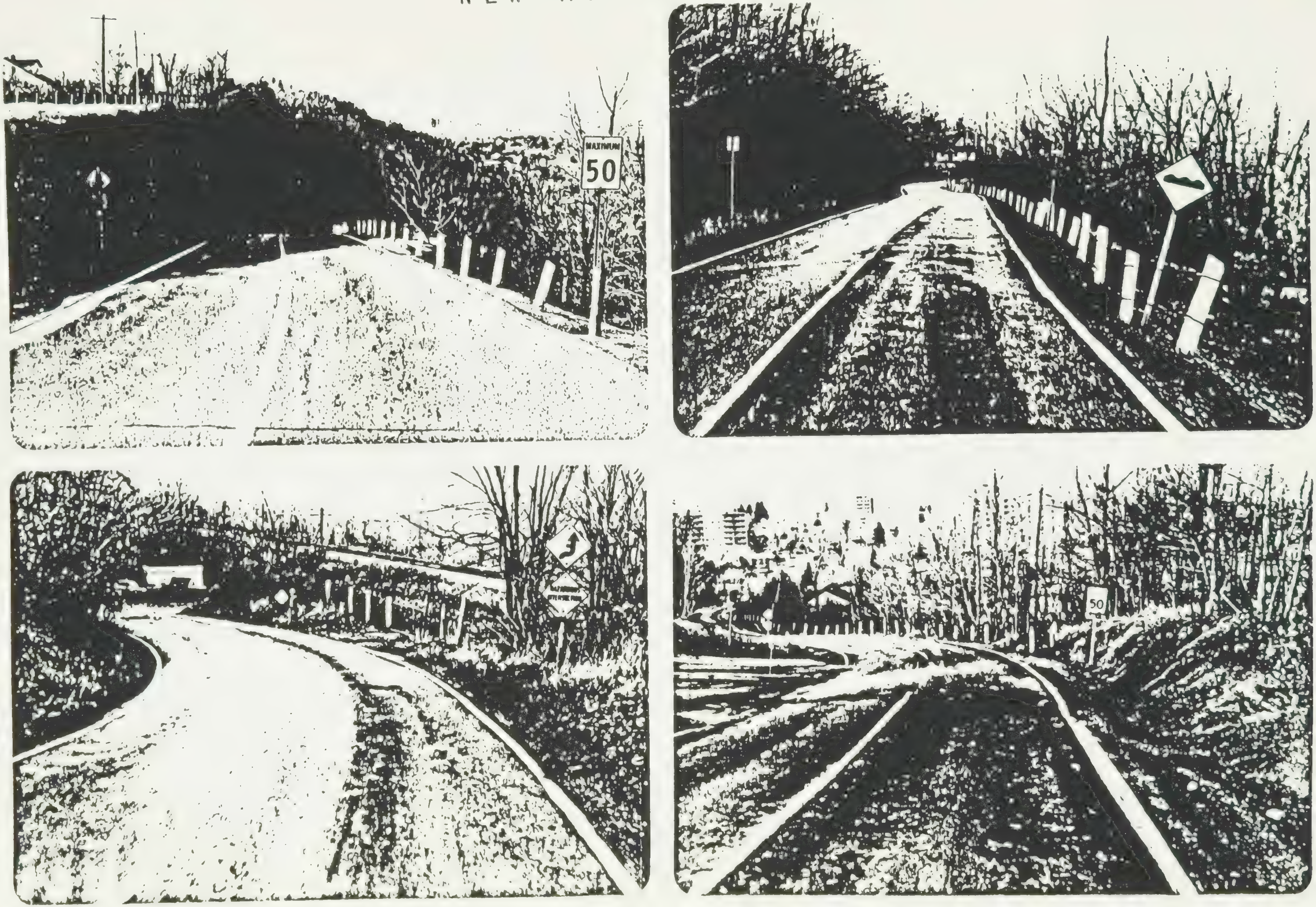
Brake Defects Reported in Collisions	
5 Year Total	- 2
Automobiles & Buses	- 2
Dump Trucks	- 0
Single Unit Heavy	- 0
Multiple Unit Heavy	- 0
Brake Defects /MV Entering	- 0.04

MV - Million Vehicles

NEW MOUNTAIN ROAD

SCALE 1" = 1000'

NEW MOUNTAIN ROAD



4. NEW MOUNTAIN ROAD

a. Description

Length - 0.8 km
Number of Lanes - 2
1981 AWDT - 3,530
Grade - 11.2% Average, 12.3% Maximum
Posted Speed Limit - 50 km/h
Urban or Rural Area - mainly rural

b. Traffic Characteristics - (% in parenthesis)

(7 - 10 a.m. plus 2 - 6 p.m. Wednesday, October 27, 1982)
(Downbound Direction Only)

Vehicle Classification		Vehicle Speeds (85th percentiles)	
Total Vehicles	- 690	All Vehicles	
Automobiles & Buses	- 679 (98.4)	Automobiles & Buses	- 62.5 km/h
Dump Trucks	- 2 (0.3)	Dump Trucks	- 46.0 km/h(1)
Single Unit Heavy	- 9 (1.3)	Single Unit Heavy	- 48.5 km/h
Multiple Unit Heavy	- 0	Multiple Unit Heavy	- None

(Ridge Road to Berkley Place)

Collision History		Collisions with Brake Defects	
5 Year Collisions /MVKM	- 17.5	Brake Defects Reported in Collisions	
5 Year Collisions	- 48	5 Year Total	- 2
Rear End	- 3 (6.3)	Automobiles & Buses	- 1
Sideswipe	- 12 (25.0)	Dump Trucks	- 1
Angle	- 8 (16.7)	Single Unit Heavy	- 0
Turning Movement	- 2 (4.2)	Multiple Unit Heavy	- 0
Approaching	- 13 (27.1)	Brake Defects/MVKM	- 0.45
Single Motor Veh.	- 7 (14.6)		
Other	- 3 (6.3)		

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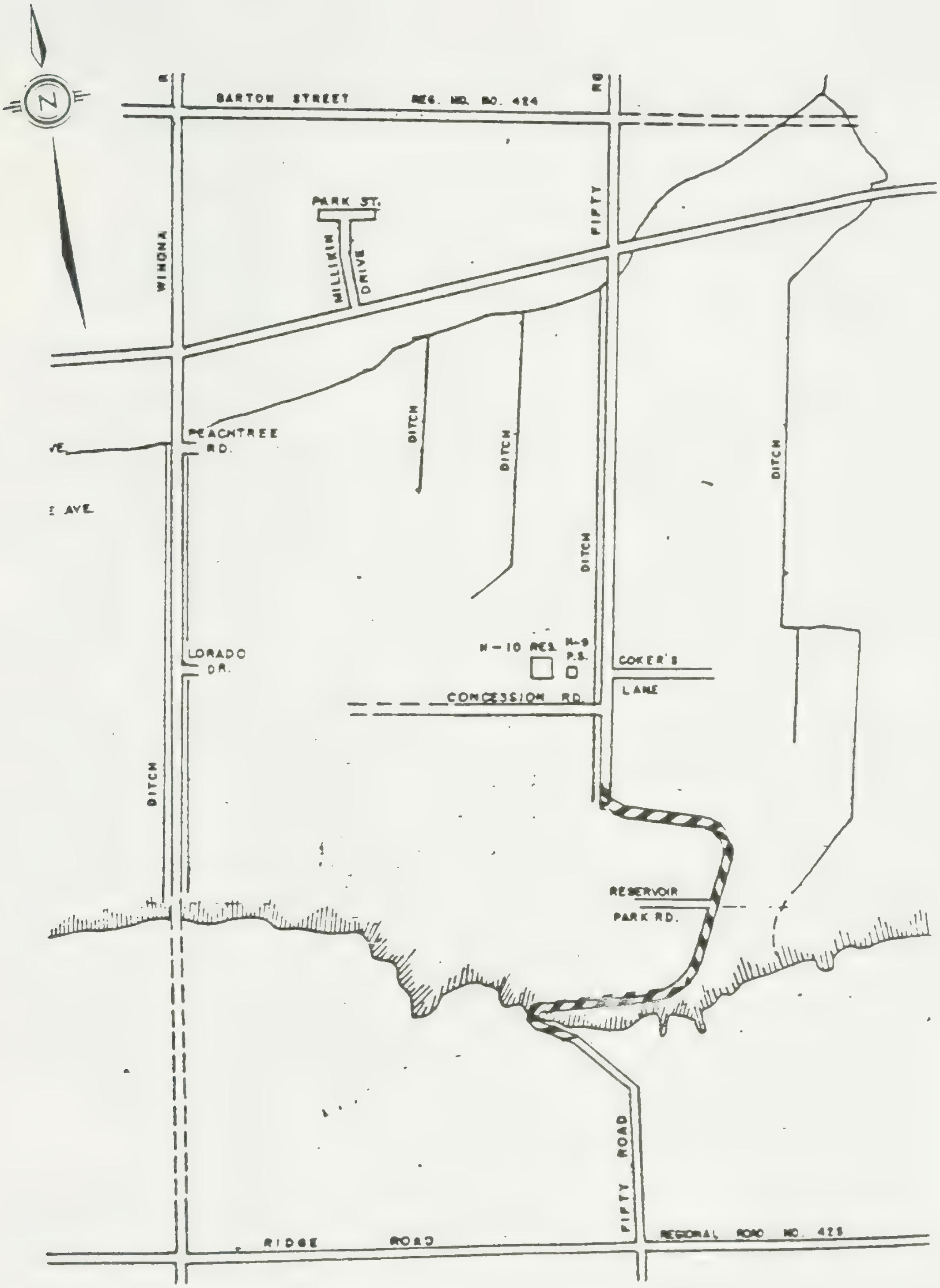
(1) Small sample size

MVKM - Million Vehicle Kilometres

FIFTY ROAD



SCALE 1" = 1000'

FIFTY ROAD

5. FIFTY ROAD

a. Description

Length - 1.16 km

Number of Lanes - 2

1981 AADT - 800 (estimated)

Grade - 8.6% Average, 12.0% Maximum

Posted Speed Limit - 60 km/h

Urban or Rural Area - rural

b. Traffic Characteristics - (% in parenthesis)

(7 - 10 a.m. plus 2 - 6 p.m. Wednesday, January 26, 1983)
(Downbound Direction Only)

Vehicle Classification		Vehicle Speeds (85th percentiles)	
Total Vehicles	- 101		
Automobiles & Buses	- 99 (98.0)	Automobiles & Buses	- 44.5 km/h
Dump Trucks	- None	Dump Trucks	- None
Single Unit Heavy	- 2 (2.0)	Single Unit Heavy	- 35 km/h
Multiple Unit Heavy	- None	Multiple Unit Heavy	- None

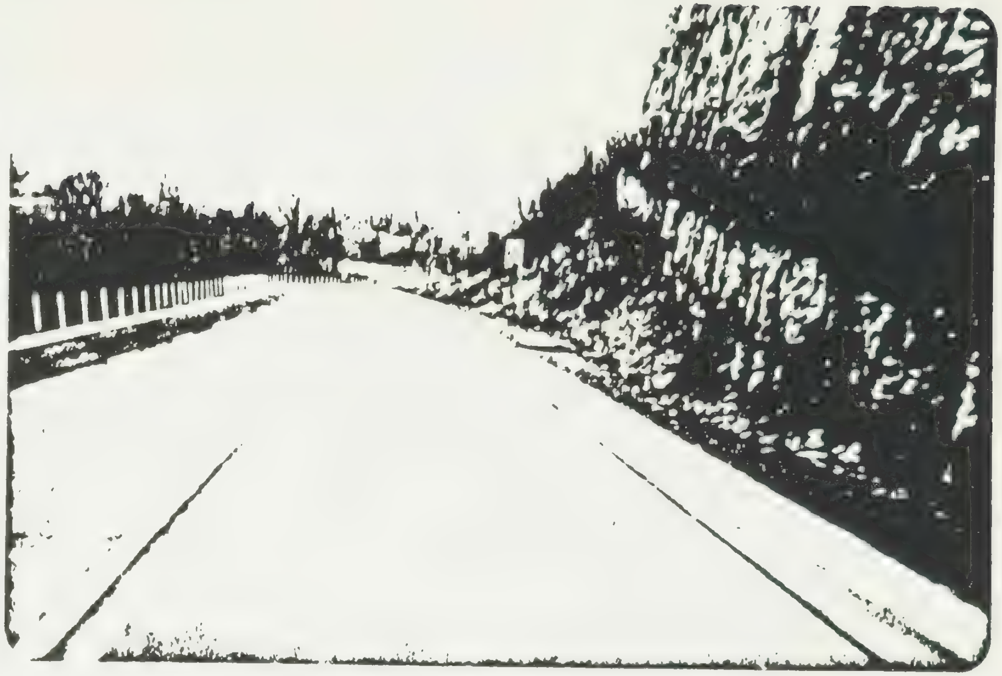
Collision History		Collisions with Brake Defects	
5 Year Collisions /MVKM	- 10.11	Brake Defects Reported in Collisions	
5 Year Collisions	- 17	5 Year Total	- 1
Rear-End	- 0 (0)	Automobiles & Buses	- 0
Sideswipe	- 3 (17.6)	Dump Trucks	- 1
Angle	- 3 (17.6)	Single Unit Heavy	- 0
Turning Movement	- 0 (0)	Multiple Unit Heavy	- 0
Approaching	- 6 (35.3)	Brake Defects/MVKM	- 0.59
Single Motor Veh.	- 4 (23.5)		
Other	- 1 (5.9)		

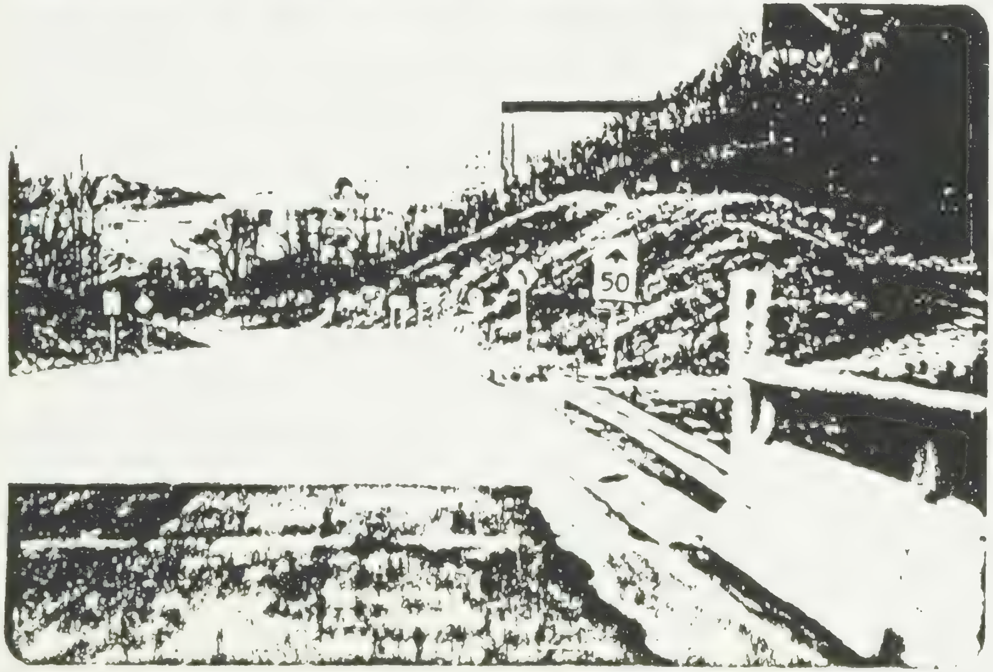
MVKM - Million Vehicle Kilometres

SYDENHAM ROAD

SCALE 1" = 1000'

SYDENHAM ROAD





6. SYDENHAM ROAD

a. Description

Length - 1.07 km

Number of Lanes - 2 up and 1 down

1981 AWDT - 3,200 (estimated)

Grade - 6.5% Average, 9.4% Maximum

Posted Speed Limit - 60 km/h

Urban or Rural Area - rural

b. Traffic Characteristics - (% in parenthesis)

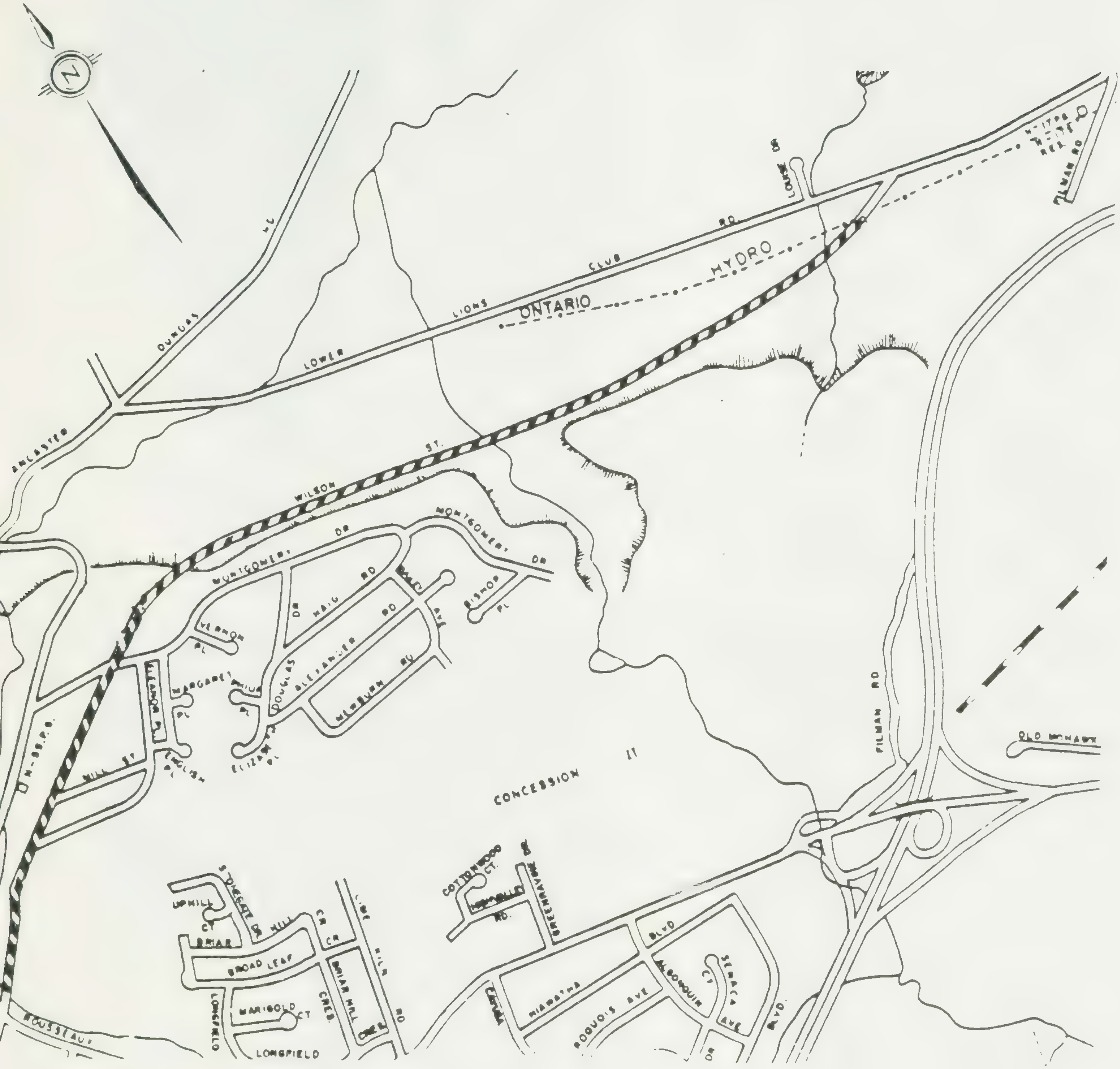
(7 - 10 a.m. plus 2 - 6 p.m. Monday, October 25, 1982)
(Downbound Direction Only)

Vehicle Classification		Vehicle Speeds (85th percentiles)	
Total Vehicles	- 570		
Automobiles & Buses	- 541 (94.9)	Automobiles & Buses	- 70.5 km/h
Dump Trucks	- 5 (0.9)	Dump Trucks	- 65.0 km/h
Single Unit Heavy	- 24 (4.2)	Single Unit Heavy	- 64.0 km/h
Multiple Unit Heavy	- 0	Multiple Unit Heavy	- None

Collision History		Collisions with Brake Defects	
5 Year Collisions /MVKM	- 0.7	Brake Defects Reported in Collisions	
5 Year Collisions	- 4	5 Year Total	- 0
Rear End	- 0	Automobiles & Buses	- 0
Sideswipe	- 0	Dump Trucks	- 0
Angle	- 0	Single Unit Heavy	- 0
Turning Movement	- 0	Multiple Unit Heavy	- 0
Approaching	- 1 (25)	Brake Defects/MVKM	- 0
Single Motor Veh.	- 3 (75)		
Other	- 0		

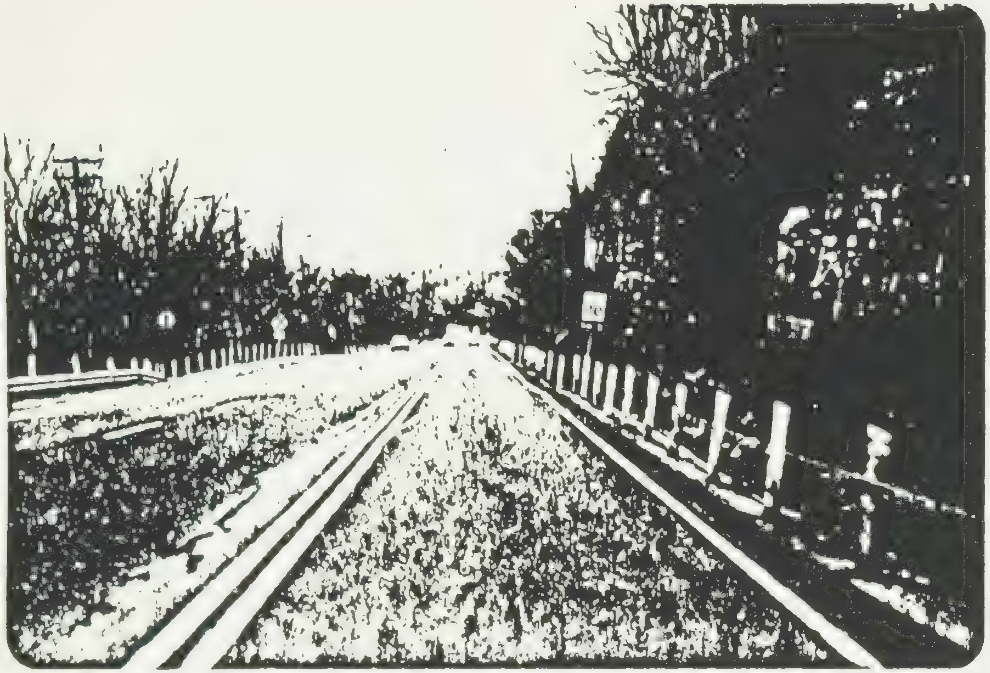
MVKM - Million Vehicle Kilometres

WILSON STREET



SCALE 1" = 1000'

WILSON STREET



7. WILSON STREET

a. Description

Length - 3.07 km
Number of Lanes - 2 (plus truck climbing lane)
1981 AWDT - 9,250 (estimated)
Grade - 3.3% Average, 5.7% Maximum
Posted Speed Limit - 70 km/h with section of 50 and 60 km/h
Urban or Rural Area - rural

b. Traffic Characteristics - (% in parenthesis)

(7 - 10 a.m. plus 2 - 6 p.m. Wednesday, October 20, 1982)
(Downbound Direction Only)

Vehicle Classification		Vehicle Speeds (85th percentiles)	
Total Vehicles	- 2,247		
Automobiles & Buses	- 2,171 (96.6)	Automobiles & Buses	- 76.5 km/h
Dump Trucks	- 16 (0.7)	Dump Trucks	- 70.5 km/h
Single Unit Heavy	- 58 (2.6)	Single Unit Heavy	- 72.5 km/h
Multiple Unit Heavy	- 2 (0.1)	Multiple Unit Heavy	- 81.0 km/h(1)

Collision History		Collisions with Brake Defects	
5 Year Collisions /MVKM	- 1.9	Brake Defects Reported in Collisions	
5 Year Collisions	- 97	5 Year Total	- None
Rear End	- 14 (14.4)	Automobiles & Buses	- 0
Sideswipe	- 11 (11.4)	Dump Trucks	- 0
Angle	- 17 (17.5)	Single Unit Heavy	- 0
Turning Movement	- 14 (14.4)	Multiple Unit Heavy	- 0
Approaching	- 15 (15.5)	Brake Defects/MVKM	- 0
Single Motor Veh.	- 17 (17.5)		
Other	- 9 (9.3)		

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(1) Small sample size

MVKM - Million Vehicle Kilometres

8. Centennial Parkway (Hwy 20)

a. Description

Length - 1.2 km
Number of Lanes - 4
1981 AWDT - 19,500
Grade - 5.7% Average, 5.7% Maximum
Posted Speed Limit - 70/50 km/h
Urban or Rural Area - mainly rural

b. Traffic Characteristics - (% in parenthesis)

(7 - 10 a.m. plus 2 - 6 p.m. Thursday, November 18, 1982)
(Downbound Direction Only)

Vehicle Classification

Total Vehicles - 5016
Automobiles & Buses - 4539 (90.4)
Dump Trucks - 69 (1.4)
Single Unit Heavy - 289 (5.8)
Multiple Unit Heavy - 119 (2.4)

Vehicle Speeds (85th percentiles)

Automobiles & Buses - 91.5 km/h
Dump Trucks - 76.5 km/h
Single Unit Heavy - 75.6 km/h
Multiple Unit Heavy - 73.5 km/h

(Intersection of King and Centennial)

Collision History

5 Year/Mvent - 1.24
5 Year Total - 78
Rear End - 22 (28.2)
Sideswipe - 5 (6.4)
Angle - 18 (23.1)
Turning - 26 (33.3)
Approaching - 0 (0.0)
Single Motor Veh. - 4 (5.1)
Other - 3 (3.9)

Collisions with Brake Defects

Brake Defects in Collisions
5 Year Total - 3
Automobile & Bus - 1
Dump Trucks - 0
Single Unit Heavy - 1
Multiple Unit - 1
Brake Defects/MVE(1) - .04

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(1) Million Vehicles Entering (the intersection)

C. COUNTERMEASURES - SUMMARY

1. LIST OF COUNTERMEASURES

	Countermeasure	Application
1.	Designated Truck Lane	Site Specific
2.	Lower Speed Limits for All Vehicles	Site Specific
3.	Differential Speed Limits	Site Specific
4.	Vehicle/Trailer Inspections	General
5.	Low Gear Legislation	General
6.	Heavy Vehicle Prohibition i) total prohibition ii) permit system	Site Specific
7.	Upper Weight Limit or Vehicle Class Restrictions	Site Specific
8.	Advisory Signs and Devices	Site Specific
9.	Escape Ramps	Site Specific
10.	Redirectional Barriers	Site Specific
11.	Traffic Signal Pre-Emption Devices	Site Specific
12.	Bridge Over Main and King Streets	Site Specific
13.	Tunnel Under Main and King Streets	Site Specific
14.	Perimeter Industrial Road	General
15.	Highway 6 Corridor Improvements	General
16.	East-West/North-South Transportation Facility	General
17.	Inspection Stations	Site Specific
18.	Automatic Monitoring/Enforcement Devices	Site Specific
19.	Driver Training and Information	General
20.	Vehicle Speed Retarding Devices	General
21.	Emergency Braking Systems	General

SUMMARY OF COUNTERMEASURE ALTERNATIVES

	COUNTERMEASURE	EFFECTIVENESS	IMPLEMENTATION COST	COMMENTS
1)	Designated Truck Lane	-not a remedial measure for vehicle defect-related collision -supplementary to escape ramp (if constructed)	$1,500 per km estimate	-not recommended unless required to ensure direct access to an escape ramp
2)	Lower Speed Limits for all Vehicles	-not a remedial measure for vehicle defect-related collisions -not a viable substitute for proper vehicle operating procedures -studies indicate ineffective	$150 per km	-not recommended
3)	Differential Speed Limits	-not a remedial measure for vehicle defect-related collisions -not a viable substitute for proper vehicle operating procedures -studies indicate ineffective -increased collision potential	$300 per km	-not recommended as the proper operating procedures for heavy vehicles already requires low operating speeds on downgrades
4)	Vehicle/Trailer Inspections	-improved vehicle mechanical fitness consistent with or higher than standards for other vehicles	borne by vehicle owner	-considered to be effective particularly for heavy vehicles not currently subject to regular inspection
5)	Low Gear Legislation	-not viable or effective	minimal	-not recommended
6)	Heavy Vehicle:-			
	i) total prohibition	-no heavy vehicle accidents on prohibited Access Routes (assuming total compliance)	$5,000 per Access	-additional transportation costs and accident potential via alternate routes
	ii) permit system	-dependent upon compliance with permit conditions	$5,000 per Access plus Administration cost	-not recommended due to jurisdictional and liability considerations

SUMMARY OF COUNTERMEASURE ALTERNATIVES

	COUNTERMEASURE	EFFECTIVENESS	IMPLEMENTATION COST	COMMENTS
7)	Upper Weight Limit or Vehicle Class Restrictions	-not a remedial measure for vehicle defect-related collisions for the non-restricted heavy vehicle classes	$7,500 per Access	-not recommended
8)	Additional Advisory Signs and Devices	-currently in place in accordance with existing standards -effectiveness uncertain	$5,000 to $20,000 per Access (for additional signs)	-low priority
9)	Escape Ramps	-only a remedial measure for vehicle defects or loss of vehicle control if ideally located and used	$300,000 to $500,000 each depending on site conditions	-low priority
10)	Redirectional Barriers	-effective for opposing vehicle streams and roadside hazards -ineffective and hazardous if openings required for vehicles or pedestrians	$80.00 to $300.00 per metre	-recommended only for opposing vehicle streams and roadside hazard locations
11)	Traffic Signal Pre-Emption Devices	-not viable or effective	$20,000 plus $12,000 per signalized intersection	-not recommended
12)	Bridge Over Main and King Streets	-not considered to be effective unless arresting devices included	$1,750,000 (approx) per lane	-not recommended
13)	Tunnel Under Main and King Streets	-not considered to be effective unless arresting devices included	$2,500,000 (approx) per lane	-not recommended
14)	Industrial Perimeter Road	-not a remedial measure for vehicles not diverted from the existing Regional Mountain Access Routes	$80,000,000 (1980 estimate)	-considered a part of overall transportation system improvements for the Region

SUMMARY OF COUNTERMEASURE ALTERNATIVES

COUNTERMEASURE	EFFECTIVENESS	IMPLEMENTATION COST	COMMENTS
15) Highway 6 Corridor Improvements (from Nanticoke)	-not a remedial measure for vehicles not diverted from the existing Regional Mountain Access Routes	to be determined	-considered a part of overall transportation system improvements for the Region
16) East-West/North-South Arterial	-not a remedial measure for vehicles not diverted from the existing Regional Mountain Access Routes	$124,000,000	-considered a part of overall transportation system improvements for the Region
17) Inspection Stations	-not cost-effective for ensuring the mechanical fitness of all heavy vehicles using a particular roadway section	Provincial responsibility	-should be considered as part of an overall Provincial inspection program
18) Automatic Enforcement Devices	-effective as an information source -does not address any vehicle defect-related conditions	$3,000 to $30,000 per unit depending on information desired	-viable as an information device -unlikely to be socially acceptable if legislated
19) Driver Training and Information	-uncertain	-negligible	-recommended -unknown whether vehicle operators are failing to follow or are unfamiliar with proper operating procedures
20) Vehicle Speed Retarding Devices	-effective if properly operated	$1,500 to $8,000 per vehicle	-low priority
21) Emergency Braking Systems	-effective only if service brakes in proper working condition	-"spring brakes" mandatory since 1975 on new trailers -retro-fit cost of $300 per axle -"dynamite brakes" in common use prior to 1975	-low priority, must be preceeded by improvements to service brake inspections

3. SUMMARY OF SITE-SPECIFIC COUNTERMEASURES

Counter Measure No.	Countermeasure	Claremont Access	Kenilworth Access	Jolley Cut	New Mountain Road	Sydenham Road	Wilson Street	Fifty Road
1)	Designated Truck Lane	*	*	*	N/A(3)	N/A(3)	N/A(3)	N/A(3)
2)	Lower Speed Limits for all Vehicles	N/R	N/R	N/R	N/R	N/R	N/R	N/R
3)	Differential Speed Limits	N/R	N/R	N/R	N/R	N/R	N/R	N/R
6)	Heavy Vehicle Prohibition							
	i) Total Prohibition	*	*	*	*	*	*	*
	ii) Permit System	*	*	*	*	*	*	*
7)	Upper Weight Limit or Vehicle Class Restrictions	N/R	N/R	N/R	N/R	N/R	N/R	N/R
8)	Additional Advisory Signs and Devices	*	*	*	*	*	*	*
9)	Escape Ramps	N/R(2)	*	N/R	N/R	*	*	N/R
10)	Redirectional Barriers(1)	N/A	*	*	*	N/R	N/R	*
11)	Traffic Signal Pre-Emption Devices	N/R	N/R	N/R	N/R	N/R	N/R	N/R
12)	Bridge Over Main and King Streets	N/R	N/A	N/A	N/A	N/A	N/A	N/A
13)	Tunnel Under Main and King Streets	N/R	N/A	N/A	N/A	N/A	N/A	N/A
18)	Automatic Monitoring/ Enforcement Devices	*	*	*	*	*	*	*

Centennial Pkwy/Hwy 20 is not included in this table as the Access portion of the roadway is under the jurisdiction of the MTC.

* indicates that countermeasure could feasibly be implemented, but is not necessarily recommended.
N/A Not Applicable.
N/R Not Recommended.

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(1) Redirectional barriers are only recommended as devices to separate opposing streams of traffic, or as protection against roadside hazards.

(2) Apparently feasible in the vicinity of Charlton Avenue. However, this is a poor location (only part way down the grade).

(3) Single downbound traffic lane.

D. COUNTERMEASURES-DETAIL

Legislative

1. Designated Truck Lane

i) Description

There are two options in terms of a designated truck lane. The first option would be an exclusive lane to be used only by heavy vehicles and no other traffic. The second option would be to designate a lane which must be used by trucks, but other types of vehicles or traffic would be allowed.

ii) Advantages

Faster moving traffic is not impeded by heavy vehicles.

If a truck escape ramp is provided, the designated lane can ensure that heavy vehicles that may require the escape ramp will be in a proper position to enter the ramp without weaving across other traffic.

iii) Disadvantages

If a lane was designated for truck use only, and excluded other vehicles, it would effectively reduce the roadway capacity significantly (in the order of 1,500 to 2,000 vehicles per hour). For this reason, exclusive designated lanes on two-lane (downbound) roadways are not recommended.

iv) Cost

The cost of implementing a designated truck lane would be in the order of $1,500.00 per km., under the assumption that existing lighting standards could be used to support appropriate overhead signs.

v) Effectiveness

A designated truck lane in itself does not have any direct effectiveness in terms of preventing a vehicle defect related collision. Its use may be considered as auxiliary to the provision of other facilities such as escape ramps to provide direct access to escape ramps without requiring a weaving manoeuvre across other traffic. A designated truck lane, if implemented, may have auxiliary benefits in terms of allowing faster moving traffic to proceed past slower moving traffic.

However, on the basis of studies conducted on the multi-lane Access Routes, only between 1 and 15 percent of heavy vehicles used the "passing" lane. This present low utilization of the "passing" lane more or less represents an "informal" designation of a truck lane. Therefore, the passage of a by-law and erection of signs would be of limited and questionable value unless required for access to an escape ramp.

vi) Potential for Application

Truck lanes could be designated on any facility with two or more lanes of traffic on the downgrade.

vii) Potential Application Sites

Not recommended unless required to ensure direct access to an escape ramp.

2. Lower Speed Limits for all Vehicles

i) Description

Lower speed limits could be implemented in order to attempt to reduce the speed of all traffic using a facility on the basis that in the event that a brake failure occurred, the speed of the vehicle at the bottom of the downgrade would be reduced and subsequently, the consequences of a collision reduced.

ii) Advantages

The advantage of a reduced speed limit in terms of addressing a brake-related failure would depend primarily on the point at which the vehicle lost its brakes or was otherwise unable to stay within the speed limit. The advantage is considered to be minimal in terms of significantly minimizing the consequences at the bottom of a grade of a brake-related defect.

iii) Disadvantages

In general, motorists proceed on a facility in accordance with their perception of an appropriate speed, and in the absence of a speed limit, motorists generally proceed at a reasonable speed given the design characteristics of the roadway, and in accordance with road and weather conditions. Attempts to reduce the speed, unless required for proper and safe vehicle operation by the posting of speed limits lower than motorist expectations, result in high violation rates. In the extreme, a high violation rate can become virtually unenforceable.

iv) Cost

There would be an additional cost in the order of $150.00 per km for those facilities which currently have speed limit signs in place.

v) Effectiveness

There is no evidence which suggests that a lower speed limit would have a significant effect on reducing the consequences of a vehicle-related defect, as, depending on the weight of the vehicle and the percent of downgrade, the vehicle would quickly approach higher rates of speed.

vi) Potential for Application

Not considered to be viable as a countermeasure for a vehicle-related (brake) defect.

vii) Potential Application Sites

Not recommended.

3. Differential Speed Limits

i) Description

A differential speed limit is the posting of a lower speed limit for different vehicle classes. As an example, heavy vehicles might have a lower posted speed limit than all other vehicles.

ii) Advantages

The advantage of a reduced speed limit in terms of addressing a brake-related failure would depend primarily on the point at which the vehicle lost its brakes or was otherwise unable to stay within the speed limit. The advantage is considered to be minimal in terms of significantly minimizing the consequences at the bottom of a grade of a brake-related defect.

iii) Disadvantages

There is a potential for increased accidents associated with speed differentials between slower and faster moving traffic. However, the results of reviewing proper vehicle operating procedures indicates that proper operation of loaded heavy vehicles on the Access Routes requires that they be operated at different speeds depending on vehicle weight (generally 15 to 30 km/h).

iv) Cost

Cost of additional signs would be in the order of $300.00 per km.

v) Effectiveness

Standard procedures as indicated in the Ontario Truck and Bus Driver's Manual states that heavy (and loaded) vehicles should routinely be travelling at lower rates of speed: "Drivers should use the same gear in descending a long grade as climbing it". Therefore, if vehicles are operated in accordance with this suggested practice, heavy vehicles descending grades should be routinely travelling at considerably lower rates of speed depending on vehicle configuration, weight and the percent downgrade.

Studies of downgrades with differential speed limits (Centennial Parkway/Hwy 20) indicate that posted differential speed limits are ineffective.

vi) Potential for Application

Should not be implemented as a substitute for proper vehicle operation.

vii) Potential Application Sites

Not recommended as heavy vehicles should proceed on downgrades at an appropriate lower rate of speed in accordance with the vehicle configuration, weight and percent downgrade.

4. Vehicle/Trailer Inspections

i) Description

This countermeasure would involve the implementation of more frequent vehicle and trailer inspections either on the basis of mileage or time period, or combination thereof.

ii) Advantages

At the present time, vehicle tractors are inspected when sold, and, with few exceptions, trailers are not subject to routine mechanical inspection. The trailer units are the most important component of the tractor-trailer braking system. Brake-related vehicle defects are an identified cause of heavy vehicle collisions(1) and equipment defects(2) could be mitigated by the implementation of a more stringent legislated inspection program for tractors and trailers.

iii) Disadvantages

The additional cost of a more stringent inspection program would ultimately be passed on to customers of the trucking companies. However, these proposed requirements are not inconsistent with the regular inspection requirement for other motor vehicles or the semi-annual inspection requirement for dump trucks licenced in the Province of Ontario.

iv) Cost

The cost of the proper inspection program would be primarily borne by the vehicle owner as opposed to the general public depending on any additional net Provincial administration costs.

v) Effectiveness

Available information concerning brake-related defects would suggest that a more stringent inspection program would be appropriate (see Appendices A & B).

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(1) Bibliography (7, pages xvii, IV-80)

(2) Bibiography (7, page V-5) (17, page 19)

vi) Potential for Application

An inspection program should apply uniformly across the Province of Ontario.

vii) Potential Application Sites

If the Provincial inspection requirements were changed, all vehicles in Ontario would be subject to the regulations.

5. Low Gear Legislation

i) Description

This alternative would be to enact some form of legislation which would require heavy vehicle operators to proceed in an "appropriate gear" when proceeding on downgrades, given the slope and length of the downgrade and the weight of the vehicle.

ii) Advantages

The primary advantage of such a legislation would be to require vehicle operators to conform to proper heavy vehicle operating procedures, or otherwise be faced with penalties through the judicial system.

iii) Disadvantages

Such low gear legislation would be awkward and difficult to implement as many variables have to be considered in terms of the weight of the vehicle, the operating characteristics of the vehicle, the length of the downgrade and the percent of grade. Such legislation would likely be unfeasible in terms of police enforcement as it would be very difficult for a police officer to determine if the unit was proceeding in the proper gear on a downgrade.

iv) Cost

The cost of such legislation would be minimal.

v) Effectiveness

Low gear legislation is not considered to be viable or effective, as the appropriate gear that should be used is dependent on many variables associated with the tractor engine, transmission engine retarders, vehicle weights, and vehicle configuration. Legislation for low gear operation is virtually unenforceable and it would be more appropriate to place emphasis on proper driver training in heavy vehicle operation.

vi) Potential for Application

Not considered viable or enforceable.

vii) Potential Application Sites

Not recommended.

6. Heavy Vehicle Prohibition

i) Description

Legislation could be passed by the Region prohibiting heavy vehicles in the downbound direction from specified Access Routes, or alternatively, restrictions could be imposed on the basis of a permit system.

ii) Advantages

Assuming total compliance with the legislation, heavy vehicles would not proceed on the specified Mountain Access Routes, and hence, by their absence, would not be involved in any collisions on the Regional Mountain Access Routes.

If the permit system were adopted, all heavy vehicles proceeding on the Access Routes would be required to conform to the conditions of the permit. Such conditions could include vehicle safety, equipment and inspection requirements, and driver operating procedures.

iii) Disadvantages

There would be increased costs associated with moving goods within the Hamilton-Wentworth Region as the potential alternate routes for heavy vehicles, such as Hwy. 403 and Hwy 6 (Clappison's Cut), would represent an additional amount of travelling cost and expense to the owners which would be passed on to the trucking company users.

It would also be appropriate to eliminate the part-time prohibition of Mohawk Road as a mitigation measure to these increased mileage and distance costs; this action would likely result in objections from the adjacent property owners and area residents. Some increase in heavy truck traffic would occur on access points to and from the Provincial Highways, such as Main Street, Mohawk Road, Mud Street, Paramount Drive and Rymal Road until such time as other limited-access facilities, such as the Mountain East-West/North-South Arterial Road and the Perimeter Industrial Road to the industrial area, are constructed.

Due to increases in vehicle mileage, hence exposure, there is a potential for increased collision involvement. However, this involvement is less likely to be of the runaway vehicle type, provided that the alternative route is via a limited access facility, such as Highway 403.

If the permit system were implemented, the Region would become involved in matters which are normally considered to be of Provincial jurisdiction; that is, vehicle licensing and inspection. In so doing, the Region could incur increased liability risks associated with the issuance of permits, particularly as the result of any subsequent collision involving a permit holder.

iv) Cost

The heavy vehicle prohibition could be enacted by changes to the truck route signing system. The estimated cost is $5,000.00 per access route. Depending on the effectiveness of the standard signs, additional information signs may be required. There would be some additional administrative costs if a permit system were implemented, depending on the complexity of the permit system. However, these costs could be offset by a permit fee.

v) Effectiveness

If a total heavy vehicle ban were implemented, this would effectively eliminate accidents associated with heavy vehicles due to their absence from the specified Mountain Access Routes. However, some accident potential would be shifted to the alternate route(s).

If a permit system were implemented and complied with, the risk of vehicle-defect collisions would be reduced without prohibiting all heavy traffic from the Access Routes.

Notwithstanding that Hwy. 20 is a Provincial Highway over the escarpment, the roadway changes to urban characteristics south of King Street, and therefore, heavy traffic should be similarly regulated if this alternative were adopted.

A total heavy vehicle prohibition or a selective prohibition (by permit) does not directly address issues related to vehicle defects or driver training which would be more effectively addressed by Province-wide regulations.

vi) Potential for Application

This measure could be applied on any of the Mountain Access Routes on which heavy truck traffic is currently permitted.

vii) Potential Application Sites

The Claremont Access, the Jolley Cut, Kenilworth Access, New Mountain Road, Wilson Street, Sydenham Road and Fifty Road.

7. Upper Weight Limit or Vehicle Class Restrictions

i) Description

Appropriate legislation could be enacted by the Region to specify an upper weight limit for heavy vehicles using the Mountain Access Routes, above which, heavy vehicles would not be allowed, or alternately, the Region could impose restrictions of vehicle classes permitted to use the access routes.

ii) Advantages

An upper weight limit, or class restriction, depending on the restriction specified, would eliminate accidents (assuming full compliance) associated with heavy vehicles in the restricted categories.

iii) Disadvantages

There would be increased costs associated with moving goods within the Hamilton-Wentworth Region as the potential alternate routes for heavy vehicles such as the 403, Hwy 6 (Clappison's Cut) and Hwy 20 would represent an additional amount of travelling cost and expense to the owners which would be passed on to the trucking company users. It would also be desireable to eliminate the part-time prohibition of Mohawk Road as a mitigation measure to these increased mileage and distance costs. Some increase in heavy truck traffic would occur on access points to and from the Provincial Highways, such as Main Street, Mohawk Road, Mud Street, Paramount Drive and Rymal Road until such time as other limited access facilities, such as the Mountain East-West/North-South Arterial Road and the Perimeter Industrial Road to the industrial area, are constructed.

Unlike the permit system (alternative 6), vehicles in the restricted category, irrespective of safety equipment and maintenance inspections would not be permitted on the Access Routes.

Heavy vehicles in the non-restricted categories, regardless of the mechanical condition, would still be permitted to use the Access Routes.

More complex and awkward signing system to designate the restrictions for heavy vehicles.

Difficult and awkward to enforce.

iv) Cost

The upper weight or vehicle class prohibition could be enacted by changes to the truck route signing system. The estimated cost is $7,500.00 per access route. Additional information signs may be required at appropriate sites.

v) Effectiveness

This alternative would eliminate accidents associated only with the restricted weight or classes of vehicles. The non-restricted classes would not be affected. However, as this alternative does not address the vehicle-defect or driver-training issues, some of the accident potential would be shifted to the alternate route(s).

Notwithstanding that Hwy. 20 is a Provincial Highway over the escarpment, the roadway changes to urban characteristics south of King Street, and therefore, heavy traffic should be similarly regulated if this alternative were adopted.

vi) Potential for Application

Not viable or effective.

vii) Potential Application Sites

Not recommended.

Physical Modifications

8. Additional Advisory Signs and Devices

i) Description

At the present time, appropriate warning signs are in place in accordance with the Ontario Manual of Uniform Traffic Control Devices advising any vehicle operators of the steep grade, and if the grade is used by trucks, an advisory tab is included to the effect "Trucks Use Low Gear". It is assumed that if any other countermeasures are applied, such as a weight limit or a truck prohibition, that the cost of implementing those measures or any signs required would be included under those alternatives. This countermeasure alternative, then, would only include additional signs and devices related to the existing operation on the Mountain Access Routes, that is, the placement of additional warning signs or devices advising of the presence of the grade ahead as supplementary to the requirements of the Uniform Manual of Traffic Control Devices.

Note: The standard sign symbol information is currently under review and may soon be ammended to include information regarding length of grade and percent of grade.

ii) Advantages

A potential advantage of the erection of additional signs and devices warning of the grade ahead would be to ensure that vehicle operators are aware of the grade in the event that any operators are not noticing and observing the existing signs that are in place. We have no evidence at this time that would indicate that drivers are or have been unaware that they were about to proceed on lengthy downgrades on the Access Routes.

iii) Disadvantages

The erection of additional signs and devices on some Access Routes could conceivably set a precedent or an informal "standard" that would have to apply to all Access Routes.

This alternative does not address the vehicle defect or driver-training issues.

iv) Cost

The cost of erecting additional signs and devices on each Access Route would vary in accordance with how elaborate a display was envisioned. If overhead structures were deployed on each Access Route, the cost could vary between $5,000 and $20,000 per Access Route.

v) Effectiveness

As indicated under "Advantages", there is no documentation at this time that suggests that drivers proceeding on the Access Routes are unaware of the grade ahead as advised by the existing warning signs. Therefore, the effectiveness of additional warning signs or devices is uncertain.

vi) Potential for Application

All Mountain Access Routes.

vii) Potential Application Sites

All Mountain Access Routes.

9. Escape Ramps and Other Energy-Absorbing Devices

i) Description

An escape ramp is a separate facility with a low weight-bearing capacity, such that the installation serves to slow a vehicle in a controlled fashion and bring it to a stop. Escape ramps are generally constructed adjacent to, or at the bottom, of a downhill grade. The escape ramp may include auxillary energy absorbing devices such as sand piles or "Fitch" barrels.

ii) Advantages

If properly designed and constructed, and should the driver elect to use the escape ramp, escape ramps, in most cases, successfully stop runaway vehicles.

iii) Disadvantages

Escape ramps are considered to be post-incident devices, that is, the incident has occurred in which the driver has lost control of the speed of the vehicle, and the ramp is used to slow down and stop the vehicle on the downgrade. The installation of the ramps in other jurisdictions has had mixed results in accordance with the following:

a) It has been suggested that a vehicle operator will enter an escape ramp as a last resort(1) after all other efforts at stopping the vehicle have failed. This may be due in part to some degree of uncertainty on the part of the driver in terms of what to expect when the vehicle enters the ramp and whether or not the ramp will effectively stop the vehicle.

b) There are instances documented where the ramps have failed to effectively prevent injury or death to the vehicle operator and/or serious damage to the vehicle.(2) However, these instances have been primarily associated with gravity ramps where the vehicle subsequently rolled backwards and jackknifed or overturned with the result that the vehicle operator was injured or killed. No instance was reported involving an injury or fatality on a pea gravel arrestor ramp, provided the ramp was properly constructed.

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(1) Bibliography (7, page IV-81) (9) (13)

(2) Bibliography (6) (13)

c) Instances have been reported where it is necessary to accommodate more than one vehicle on the escape ramp.(1) There have been instances where a vehicle entered the ramp while there was still a vehicle left in the ramp from a previous incident. If an additional vehicle is to be accommodated, construction costs are subsequently higher.

d) Escape ramps do not address any problems related to defective vehicles and/or driver-operating procedures.

e) Escape ramps have undesirable aesthetic and environmental implications.

i) A large escape ramp would be required, between 350 m (1100 ft) to 600 m + (2000 ft) in length, depending on any upgrade available.

ii) "Arrester ramps" which utilize sand or pea gravel with or without supplementary arresters, such as sand piles or "Fitch" energy-absorbing devices, require a parallel and hard-surfaced access road and anchoring equipment to extract a vehicle which has used the escape ramp.

iii) In cold weather climates, the sand or pea gravel arresting beds must be treated with an anti-freeze solution, such as calcium chloride.

iv) Depending on the terrain of the area, various forms of slope stabilization, such as large areas of fill or retaining walls, may be required.

f) Where energy absorbing barriers are required due to limited space available for an escape ramp, the potential for jackknifing can be mitigated by the installation of horizontal guiderail beams adjacent to the energy barrier. However, this increases the potential of the trailer unit and load crushing the vehicle cab, due to the higher cab deceleration rate.

g) Any energy absorbing barrier would be out of service until reinstalled. Such reinstallation could take days or possibly weeks to accomplish, and the escape device would be out of service during this period of time.

h) There are liability issues associated with escape ramps, such as their ability to accommodate any type of configuration or weight of vehicle and speed of vehicle that might enter the ramp.(2) If the ramp does not perform as designed or intended, the roadway authority could subsequently be liable for any damages to the vehicle or operator.

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(1) Bibliography (12) (14) (16, page 9)

(2) Bibliography (7, page IV-84)

iv) Cost

A typical ramp, if a suitable location could be found, and dependent on site conditions, may cost between \$300,000 to \$500,000.(1) Additional maintenance costs are incurred to prevent icing of the ramp surface and to restore the ramp surface and arresting devices after each usage.

v) Effectiveness

Escape ramps, where properly designed and constructed, have, in most cases, successfully stopped runaway vehicles witn minimal damage.

vi) Potential for Application

Truck escape ramps might be considered on any Mountain Access Route that has an area at the bottom of the grade of sufficient length and at a favourable geometric angle to the roadway for the ramp to be entered safely.

vii) Potential Application Sites

Claremont Access, Kenilworth Access, Sydenham Road, Wilson Street.

10. Redirectional Barriers

i) Description

Redirectional barriers are devices which can be utilized to redirect a runaway vehicle away from pedestrians, buildings or properties adjacent to the roadway or opposing traffic or roadside hazards in an effort to contain the vehicle within the roadway.

ii) Advantages

Redirectional barriers, if constructed to a sufficient strength to withstand the impacts of heavy vehicles, and loads could conceivably contain the vehicle and/or vehicle load within the roadway.

Redirectional barriers might successfully be deployed to prevent head-on or single vehicle collisions involving vehicles on Mountain Access curves such as the Jolley Cut or any other curves where there is a documented problem of vehicles crossing the center or edge line of the roadway.

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(1) Bibliography (3, page 8) (14)

iii) Disadvantages

a) The redirectional barrier, if used in an effort to protect adjacent pedestrians or property, is a post-incident device and would not address any problem associated with vehicle mechanical defects or improper driving procedures.

b) Redirectional barriers are effective at low incident angles. At high incident angles, the barrier could result in injury or death to the vehicle operator.(1)

c) The barrier, if used to contain the vehicle within the roadway, could result in the vehicle being redirected into the path of other vehicles and vehicle occupants on the roadway, whereas depending on the circumstances, the vehicle might have left the roadway with less overall damage to vehicles and occupants.

d) Redirectional barriers are not recommended at locations where access through the barrier is required for vehicles or pedestrians (eg driveways and pedestrian crosswalks).

The barrier could be penetrated at the openings, and the ends of the openings, thereby representing a fixed-object hazard to vehicles.

e) The Municipality could be liable if the redirectional barrier failed to perform as intended.

iv) Cost

The cost of the redirectional barrier would vary in accordance with its design. Typical redirectional barriers on freeways are in the order of $80.00 per metre. However, high energy vehicles would require a more expensive design potentially in the order of $300.00 per metre.

v) Effectiveness

Redirectional barriers have been successfully applied as separators between opposing traffic or to protect vehicles from roadside hazards.

The installation of sections of redirectional barriers with openings for vehicle and pedestrian access is not recommended.

vi) Potential for Application

Redirectional barriers might be effectively deployed on sections of roadway which have a documented history of collisions involving opposing traffic or collisions involving fixed objects at the side of the roadway.

vii) Potential Application Sites

Sherman Access curve, the three Jolley Cut curves.

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(1) Bibliography (7, page IV-85)

11. Traffic Signal Pre-Emption Devices

i) Description

Traffic signal pre-emption devices would pre-empt all traffic signals at the bottom of a grade in favour of vehicles proceeding on the grade. Pre-emption devices have to be activated in some fashion by the characteristics of the vehicle proceeding on the downgrade (eg high speed sensors or a transmitter installed on the runaway vehicle).

ii) Advantages

If successfully deployed, traffic signals could be pre-empted to give a green indication to the vehicle proceeding on the downgrade and stopping all cross traffic.

iii) Disadvantages

a) The runaway vehicle has to be detected sufficiently enough ahead of time to clear all cross-street traffic and pedestrian traffic, as well as any vehicles at the bottom of the grade standing in queues at the traffic signals. The pre-advance warning time would be in the order of 30 seconds for a facility such as the Claremont Access, which would in turn mean it would be necessary to detect a "runaway" vehicle that was travelling at 130 km/h in the order of 1,050 m before the intersection. On this basis, a vehicle within 1,050 m could not be successfully detected as a "runaway" in sufficient advance time to clear the intersection(s).

b) The Municipality could be liable if the redirectional barrier failed to perform as intended.

c) Inadvertent deployment of the device would result in considerable congestion at the pre-empted intersections, as it would be necessary to hold any pre-emption signal for a considerable period of time.

d) There is no feasible means of testing the device without simulating the runaway conditions. This in itself would be hazardous.

iv) Cost

The cost of a pre-emption device per intersection would be in the order of $12,000.00. Additional costs would be in the order of $20,000.00 for detection equipment, which in accordance with the above, is not considered to be feasible or viable. An alternative arrangement would require transmitters on every heavy truck that might utilize the Access. These transmitters would cost in the order of $800.00 to $1,000.00 per vehicle, and an additional cost per intersection in the order of $2,500.00.

v) Effectiveness

This countermeasure is not considered to be feasible or viable.

vi) Potential for Application

Not considered to be viable.

vii) Potential Application Sites

Not recommended.

12. Bridge (Single or Multi Lane) over Main and King Sts.

i) Description

This countermeasure would involve the construction of a single or multi-lane bridge over Main and King Streets or on other Mountain Access Routes with traffic-signalized intersections at the bottom of the grade.

ii) Advantages

A bridge could potentially provide a vehicle path that would not result in any conflict with cross-traffic at those intersections at which the overpass was constructed. If the bridge was available to general traffic, roadway capacity might be increased.

iii) Disadvantages

a) If a bridge were constructed, the roadway would eventually return to grade and the vehicle would subsequently regain its momentum and have to deal with cross traffic at subsequent intersections downstream of the bridge structure.

b) In order to be effective for a runaway vehicle, the bridge or structure would have to include a dedicated lane or lanes which are designed as escape ramps including vehicle arresting devices.

c) Aesthetically undesirable.

iv) Cost

$6.5 million per lane mile. On this basis, a single-lane bridge over Main and King might cost in the order of $1,750,000

v) Effectiveness

Not considered to be effective unless there are no downstream conflicts or intersections.

vi) Potential for Application

Not considered to be a viable countermeasure for runaway vehicles.

vii) Potential Application Sites

Not recommended.

13. Tunnel (Single or Multi Lane) Under Main and King Sts.

i) Description

This countermeasure would involve the construction of a single or multi-laned tunnel on Main and King Streets or at the bottom of other Mountain Access Routes with traffic-signalized intersections at the bottom of the grade.

ii) Advantages

A tunnel could potentially provide a vehicle path that would not result in any conflict with cross traffic at those intersections under which the tunnel was constructed.

iii) Disadvantages

a) If a tunnel were constructed, vehicle momentum would increase entering the tunnel, and would have to include designated lanes or lanes as escape ramps including vehicle arresting devices.

b) In order to be effective for a runaway vehicle, the tunnel or structure would have to be clear at all times for the use of the runaway vehicle.

iv) Cost

The cost would be highly dependent on various factors associated with existing underground utilities, building foundations and soil conditions. Generally, tunnel construction would be more expensive than bridge construction. Costs would likely exceed $1,750,000.

v) Effectiveness

Not considered to be effective unless there are no downstream conflicts or intersections.

vi) Potential for Application

Not considered to be a viable countermeasure.

vii) Potential Application Sites

Not recommended.

14. Perimeter Industrial Road

i) Description

The Perimeter Industrial Road involves the construction of a connection between Highway 403 and the industrial area in accordance with the Regional Official Plan.

ii) Advantages

Most truck movements to and from the Bayfront industrial area could be rerouted to the highway system outside of the urban-populated area via the Perimeter Industrial Road and the recently reconstructed Burlington Street.

iii) Disadvantages

Local heavy truck traffic would continue on the Mountain Access Routes.

iv) Cost

Estimated cost in 1980 was $80 million.

v) Effectiveness

As a countermeasure to runaway vehicles, the Industrial Perimeter Road would potentially reduce the possibility of having runaway vehicle incidents on the urban Mountain Access Routes, but only associated with vehicles that would utilize the alternate facility. However, there is still the potential for runaway accidents on the highway system and this alternative does not directly address problems related to vehicle defects or driver training.

vi) Potential for Application

Alternate facility for traffic destined to the Industrial area.

vii) Potential Application Sites

Not applicable.

15. Hwy 6 Corridor Improvements (from Nanticoke)

i) Description

The Highway 6 corridor involves the designation of a limited access connection between Highway 6 south of the City and Hamilton's peripheral arterial or Highway system.

ii) Advantages

Some truck movements, depending on the corridor designation, might be rerouted to the arterial or highway system outside of the urban-populated area.

iii) Disadvantages

Other truck traffic which would not use the designated facility would continue on the Mountain Access Routes.

iv) Cost

To be determined (Route corridor designation study is currently underway).

v) Effectiveness

As a countermeasure to runaway vehicles, the Highway 6 corridor would potentially reduce the possibility of having runaway vehicle incidents on the urban Mountain Access Routes. However, there is still the potential for runaway accidents on the highway system and this alternative does not directly address any problems related to vehicle defects or driver training.

vi) Potential for Application

Under study by the Province.

16. East-West, North-South Transportation Facility

i) Description

The East-West, North-South Facility includes the construction of a connection between the Q.E.W. and the Mountain Industrial area and Highway 403 in accordance with the Regional Official Plan.

ii) Advantages

Truck movements would be rerouted via this controlled access facility to the highway system and the Bay Front Industrial Area.

iii) Disadvantages

Other truck traffic who would not use the facility would continue on the Mountain Access Routes.

iv) Cost

Estimated cost is $124,000,000.

v) Effectiveness

As a countermeasure to runaway vehicles, the East-West, North-South connection to the 403 and Q.E.W. would potentially reduce the possibility of having runaway vehicle incidents on the urban Mountain Access Routes. However, there is still the potential for runaway accidents on the highway system and this alternative does not directly address any problems related to vehicle defects or driver training.

vi) Potential for Application

In approval stages.

vii) Potential Application Sites

Not site-specific.

Enforcement/Inspections

17. Inspection Stations

i) Description

Inspection station(s) could be constructed or portable stations set up on a random basis to require all trucks to stop and be weighed and inspected on a spot-check basis in accordance with Ministry of Transportation and Communications procedures.

Background Information:

Between November 1, 1982, and December 7, 1982, the Ministry of Transportation and Communications inspected 165 heavy vehicles within the Region. Of these vehicles, 47 were detained, 23 had their plates removed and 19 charges were laid (See Appendix B).

On the basis of commercial motor vehicle inspections conducted by the Province from March 1, 1980, to April 31, 1982, of 34,226 vehicles equipped with air brakes, 11,021 (32.2%) had defective brakes. Of 12,717 vehicles equipped with hydraulic brakes, 1,989 (15.6%) had defective brakes (see Apprendix A).

ii) Advantages

Some defective trucks might be detected at the inspection stations.

iii) Disadvantages

a) Depending on the location of the inspection stations, truck operators could take alternative routes to avoid inspection.

b) Depending on the operating hours of the station, and the frequency of the spot checks, defective trucks could go undetected.

iv) Cost

The cost of inspection stations, either permanent or portable, would be borne by the Ministry of Transportation and Communications.

v) Effectiveness

The primary purpose of an inspection station is to control excessive vehicle loading (and damage to) roadways. Inspection stations, either permanent or portable, are not considered as a cost-effective method of ensuring the mechanical fitness of vehicles using a particular section of roadway.

vi) Potential for Application

Inspection stations might be considered for installation, in accordance with an overall Provincial program, to monitor the mechanical fitness and compliance with the Highway Traffic Act with respect to heavy vehicle operation maintenance and licencing.

vii) Potential Application Sites

Highway 20, south of the City limits, and Highway 6, south of the City limits, or portable stations temporarily set up at any suitable locations in the Region.

18. Automatic Monitoring/Enforcement Devices

i) Description

An automatic enforcement device is a device that can automatically detect and photograph either speeding violations or the use of Mountain Access Routes by unauthorized vehicles.

Background Information: The technology is available to detect trucks by vehicle configuration or detect speeding vehicles automatically, and photograph the vehicle licence number or identification, including the time of day and speed of the vehicle. These infractions could be brought to the attention of the vehicle owner/operator, or with changes in legislation to the Highway Traffic Act could be used to enforce speeding or other moving violations.

ii) Advantages

a) These devices would provide a permanent and constant record of either speeding or vehicle configuration violations on the Access Route(s). In order to reduce the monitoring costs, these units could be moved from one access point to another at different times of the year.

b) All information concerning violations while the device was activated could be forwarded to the vehicle owner for their information and appropriate corrective actions.

c) If changes to the Highway Traffic Act were made, the information recorded with these devices might be used to obtain convictions in court.

iii) Disadvantages

a) Legislation changes would be necessary for evidence from the device to be acceptable in the courts.

b) This type of device might be considered socially unacceptable if intended for use as evidence in court.

c) The device in itself does not address any problems related to mechanical fitness of vehicles or improper driving procedures.

iv) Cost

Individual devices cost between $3,000.00 and $30,000.00, depending on the amount and complexity of the information desired.

v) Effectiveness

The device might be successfully deployed (if Legislation was changed) as an enforcement device. However, it might be equally effective as an information device, particularly in cases where the vehicle operator is not the vehicle owner.

The device has very little countermeasure potential in terms of vehicle-defect related problems.

Background Information: These devices have been used for recording purposes in North America and for enforcement purposes in some European countries.

vi) Potential for Application

The device could be installed on any Mountain Access Route.

vii) Potential Application Sites

Any Mountain Access Route within the Region.

19. Driver Training and Information

i) Description

Increased emphasis could be placed on driver training, particularly for the A licence designations for authorization to operate heavy vehicles. Specific emphasis could be placed on vehicle characteristics on downgrades and appropriate driving and emergency procedures for heavy vehicles and buses (driver licence classes A, B, C, D, E, F and G).

Background Information: According to speed studies recently performed on the Mountain Access Routes, it would appear that few heavy vehicles are complying with the appropriate recommended driving procedures for downgrades. It should be emphasized that although these procedures do not appear to be followed, it does not necessarily mean that they are unknown to the driver.

Certain class D motor vehicles may be operated by class G licence holders in accordance with Ontario Regulation 462, Section 3. It is suggested that the basis of this exemption be reviewed, particularly for air brake equipped vehicles when not operated by the vehicle owner.

Specific information should be readily available to the driver, indicating the proper gear, engagement of engine retarding device (if so equipped), the length of the grade, percent grade, vehicle configuration and weight characteristics.

ii) Advantages

Increased emphasis on driver procedures for downgrades may result in improved compliance with the recommended downgrade procedures in the Ministry of Transportation and Communications Truck and Bus Driver's Manual. In the manual, the recommended practice is to proceed on the downgrade in the same gear in which the vehicle would proceed on the upgrade.

iii) Disadvantages

Additional training procedures may increase the training period required to obtain a licence to operate heavy vehicles.

iv) Cost

Some additional costs would be associated with improved training procedures (to be borne by the licence applicant) and dissemination of vehicle operational instructions (to be borne by vehicle manufacturer or operator).

v) Effectiveness

As it is not currently known whether or not failure to follow proper procedures is as a result of training and information deficiencies, or a choice on the part of drivers not to use the recommended procedure, the effectiveness of this alternative is uncertain. However, studies done in other jurisdictions indicated driver training to be a factor in "runaway" heavy vehicle collisions.(1)

vi) Potential for Application

As this is a generalized training and information procedure, if the procedure was followed by the operators of heavy vehicles and buses, it would be in effect on all Mountain Access Routes.

vii) Potential Application Sites

Not site-specific.

20. Vehicle Speed-Retarding Devices

i) Description

Truck or other vehicle retarding devices provide driveline forces on vehicles to "manage" or otherwise control vehicle speeds. Several different types are available based on engine exhaust, hydraulic, electric or gearing systems.

These units are capable of retarding or controlling vehicle speeds provided that the driveline is engaged (engine and transmission in gear) and the proper gear has been selected for the grade.

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(1) Bibliography (13) (17)

Retarding devices are in common use in the mountainous Western Provinces and States. It is estimated that approximately 30 percent of tractor units operated in the Province of Ontario are currently equipped with engine retarding devices.

ii) Advantages

Engine-retarding devices can provide an effective means of controlling heavy vehicle speeds on downgrades. Engine retarding devices are also claimed to:

- extend the life of the regular service brakes (two to three times)
- reduce tire wear
- cleaner engine operation

iii) Disadvantages

The additional cost of the units would be passed on to the tractor purchaser. However, these units represent only 2% of the additional cost of a tractor unit based on the average cost of a factory-installed engine-braking device of $1,500, and a cost of a tractor unit of $70,000. Increased engine wear is claimed, as well as noisier engine operation.

iv) Cost

Factory-installed, (depending on type) $1,500 (exhaust) to $8,000 (electric). Retro-fit, $2,500 (exhaust) to $8,000 (electric).

v) Effectiveness

Under field conditions, and if operated properly, these devices have proven to be effective at controlling vehicle speeds.

vi) Potential for Application

If all heavy vehicles were required to have the devices, they would be effective for all Mountain Access Routes at controlling vehicle speeds (if properly operated and engaged).

vii) Potential Application Sites

Not site-specific.

21. Emergency Braking Systems

i) Description

"Spring" brakes are currently mandatory on all trailer units manufactured after 1975. "Spring" brakes activate the trailer service brakes if the air pressure fails. The "spring" brake is not really a brake, but a secondary or back-up means of activating the service brakes. It is only effective if the service brakes (drums and linings, etc.) are in proper condition.

ii) Advantages

Emergency braking systems provide a backup system to the primary means of activating the service brakes. Prior to 1975, other emergency braking systems were in common use ("dynamite" brakes).

iii) Disadvantages

"Spring" brakes, or other emergency brake systems, are only effective if service brake mechanisms are fully operative, i.e. brake shoes and drums, etc.

iv) Cost

Factory installed: "spring brakes" are mandatory for all trailer units since 1975.

Retro-fit: $300 per axle.

Emergency braking systems, such as the "spring brake", represent an expenditure of $600 on the average trailer (dual wheels) unit cost of $17,000 (3.5 percent of trailer cost).

v) Effectiveness

"Spring" brakes, or other types of emergency braking systems, are effective in providing an auxiliary method of activating the service brakes of trailer units, provided that the service brake components (brake shoes, drums, etc.) are in proper working order.

vi) Potential for Application

If these devices were mandatory, all trailer units proceeding on the Mountain Accesses would be so equipped.

vii) Potential Application Sites

Not site-specific.

APPENDIX A

COMMERCIAL MOTOR VEHICLE INSPECTION

TIME PERIOD FROM 80 04 01 TO 81 03 31

Components	Number of Vehicles Inspected With Listed Component	Number of Defective Vehicles	% Found Defective	Number of Vehicles Detained For This Reason	Detained for Listed Components
Sheet Metal	46,943	2,203	4.6	171	7.7
Glass	35,117	1,525	4.3	15	.9
W/Wipers	35,117	1,057	3.0	8	.7
Mirrors	35,117	872	2.4	2	.2
Horn	35,117	1,106	3.1	12	1.0
Fuel System	35,117	730	2.0	83	11.3
Exhaust System	35,117	3,029	8.6	81	2.6
Lights and Reflectors	46,943	18,649	39.7	3,553	19.0
Steering	35,117	6,017	17.1	178	2.9
Steering Box Insecure	35,117	395	1.1	191	48.3
Tie Rod Ends - Left & Right	35,117	1,626	4.6	265	16.2
Drag Link - Front & Rear	35,117	2,259	6.4	215	9.5
Idler Arm	35,117	1,279	3.6	130	10.1
Steering Wheel Play	35,117	809	2.3	303	37.4
Suspension & Frame	46,943	8,024	17.0	187	2.3
Spring - Shackles - U Bolts	46,943	5,452	11.6	456	8.3
Equalizers - Torque Rods	46,943	614	1.3	50	8.1
Frame - Crossmember - Cracks	46,943	1,395	2.9	158	11.3
Tires	46,943	5,630	11.9	591	10.4
Wheels	46,943	1,548	3.2	18	1.1
Bent - Loose	46,943	261	.5	60	22.9
Studs Broken - Nuts Missing	46,943	1,211	2.5	76	6.2
Parking Brake	35,117	1,737	4.9	179	10.3

Components	Number of Vehicles Inspected With Listed Component	Number of Defective Vehicles	% Found Defective	Number of Vehicles Detained For This Reason	Detained for Listed Components
Brakes - Hydraulic	12,717	1,989	15.6	152	7.6
Fluid Leakage	12,717	138	1.0	108	78.2
Low Pedal	12,717	1,020	8.0	242	23.7
Brakes - Electric - Vacuum	12,717	440	3.4	302	68.6
Brakes - Air	34,226	11,021	32.2	218	1.9
Hoses - Lines - Couplings	34,226	1,724	5.0	387	22.4
Valves - Shut Off Cocks	34,226	341	.9	98	28.7
Chambers	34,226	1,318	3.8	499	37.8
Linings - Drums	34,226	1,235	3.6	306	24.7
Audible Air Leaks	34,226	1,591	4.6	606	38.0
Push Rod Travel Excessive	34,226	6,506	19.0	3,019	46.4
Warning Device Inoperative	22,412	1,268	5.6	233	18.3
Slow Build Up	34,226	97	.2	24	24.7
Fifth Wheel Assembly	15,171	1,841	12.1	37	2.0
Lower Mounting - Cracks	15,171	530	3.4	19	3.5
Bolts - Loose - Missing	15,171	1,163	7.6	76	6.5
Upper Plate & King Pin	11,793	435	3.6	96	22.0
Pintle	1,629	80	4.9	9	11.2
Ineffective or no Safety Pin	1,629	34	2.0	19	55.8
Pintle Mounting Cracks	1,629	17	1.0	3	17.6
Bolts - Loose - Missing	1,629	14	.8	5	35.7
"A" Frame or Tow Bar	2,210	30	1.3		
Cracks - Broken Welds	2,210	15	.6	2	13.3
Ineffective Lunette or Eye	2,210	15	.6	5	33.3
Safety Cables or Chains	2,210	757	34.2	108	14.2
Under Size - Defective	2,210	277	12.5	88	31.7
Cables - Chains - Too Long	2,210	161	7.2	23	14.2
Clamps - Insufficient	2,210	49	2.2	6	12.2
Clamps - Installed Wrong	2,210	51	2.3	12	23.5
Chocks - Shackles - Undersize	2,210	203	9.1	32	15.7
Other Defects	46,943	1,552	3.3	39	2.5

SUMMARY OF INSPECTED VEHICLES

Number of Vehicles Inspected	46943
Charges Under HTA	1175
Removed From Service	7883
W.O'S Issued	1127
Number of Plates Removed	895
10-29's Issued	1524
Roadside Inspections	34401
Terminal Inspections	12542

APPENDIX B

COMMERCIAL MOTOR VEHICLE INSPECTIONS IN HAMILTON-WENTWORTH REGION
BY
THE MINISTRY OF TRANSPORTATION AND COMMUNICATIONS

Inspection Dates (1982):

November 1st., 9th., 16th., 18th., 22nd., 23rd., 24th., 25th., 26th., and

December 7th.

Inspection Dates (1983)

February 15th, 22nd
March 1st, 8th, 10th, 15th
April 6th, 13th, 20th, 26th
May 3rd, 10th, 17th, 24th
June 1st

Results

Number of Vehicles Inspected	655
Number of Charges Laid	109
Number of Vehicles Detained	192
Number of Vehicles - Plates Removed	71

APPENDIX C
HEAVY VEHICLE REGISTRATIONS IN THE PROVINCE OF ONTARIO
1981

	Weight Class							
Vehicle Type	1 - 2,400 Kg	2,400 - 5,000 Kg	5,000 - 10,000 Kg	10,000 - 15,000 Kg	15,000 - 20,000 Kg	20,000 - 25,000 Kg	25,000 - 30,000 Kg	30,000 - 35,000 Kg
Box	162	401	568	1,044	179	77	36	1
Dump	116	1,394	3,653	8,165	2,158	8,109	3,421	271
Flat Bed	315	1,623	1,374	1,643	378	586	223	53
Pick Up	428, 461	66,252	1,772	431	58	61	31	7
Stake	612	5,170	5,007	4,515	746	816	200	64
Tanker	47	78	687	3,197	1,008	768	203	10
Tractor	1,816	6,929	5,625	4,632	2,092	4,346	5,556	3,908
Tow Truck	240	2,658	695	233	36	11	5	0
Van	142,986	60,025	11,553	9,593	977	810	138	12
Other	10,964	6,604	4,244	5,764	1,812	2,618	2,380	805
TOTAL	585,719	151,134	35,178	39,217	9,444	18,202	12,193	5,131

	Weight Class							
Vehicle Type	35,000 - 40,000 Kg	40,000 - 45,000 Kg	45,000 - 50,000 Kg	50,000 - 55,000 Kg	55,000 - 60,000 Kg	60,000 - 65,000 Kg	Other	All Weight Classes
Box	0	2	2	1	0	0	11	2,484
Dump	158	105	124	53	24	71	75	27,897
Flat Bed	39	58	90	92	19	12	39	6,544
Pick Up	18	8	8	8	11	4	1,117	498,247
Stake	17	39	59	22	9	15	51	17,342
Tanker	18	12	19	25	8	0	17	6,097
Tractor	11,721	5,051	6,601	5,860	3,484	1,419	157	69,197
Tow Truck	1	0	0	1	2	0	12	3,894
Van	14	19	7	3	2	0	492	226,631
Other	863	314	456	414	311	104	202	37,855
TOTAL	12,849	5,608	7,366	6,479	3,870	1,625	2,173	896,188

APPENDIX D

1981
HAMILTON-WENTWORTH
VEHICLE CLASSIFICATION

4 Cylinder	48,162
6 Cylinder	49,766
8 Cylinder	111,398
Trailer	26,537
Truck	34,173
Farm Vehicle	874
Bus	571
School Bus	41
Motorcycle	5,863
Steam or Electric	10
Moped	418
TOTAL	277,813

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